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03-06-2021 | Batch : **MEDICAL 2021**
REPEATERS NEET MODEL EXAM - UNIT I, II, III, IV, V
Physics + Chemistry + Biology

Version
A

Time: 3 hrs.
Max. Mark: 720

PHYSICS

Q.1) If energy (E), velocity (V) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be:

1) $[EV^{-1}T^{-2}]$
2) $[EV^{-2}T^{-2}]$
3) $[E^{-2}V^{-1}T^{-3}]$
4) $[EV^{-2}T^{-1}]$

Q.2) The pair of quantities having same dimensions is

1) Young's modulus and energy
2) impulse and surface tension
3) angular momentum and work
4) work and torque

Q.3) The percentage errors in the measurement of mass and speed are 2% and 3% respectively. The error in kinetic energy obtained by measuring mass and speed will be

1) 12%
2) 10%
3) 8%
4) 2%

Q.4) A particle has initial velocity $(3\hat{i}+4\hat{j})$ and has acceleration $(0.4\hat{i}+0.3\hat{j})$. It's speed after 10s is:

1) 7 units
2) $7\sqrt{2}$ units
3) 8.5 units
4) 10 units

Q.5) The displacement of a particle varies with time (t) as : $s = at^2 - bt^3$. The acceleration of the particle will be zero at time t equal to

1) $\dfrac{a}{b}$
2) $\dfrac{a}{3b}$
3) $\dfrac{3b}{a}$
4) $\dfrac{2a}{3b}$

Q.6) The water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at an instant when the first drop touches the ground . How far above the ground is the second drop at that instant? (Take g= 10 m/s²).

1) 1.25 m
2) 2.50 m
3) 3.75 m
4) 5.00 m

Q.7) What is the linear velocity if angular velocity vector $\overline{\omega} = 3\hat{i} - 4\hat{j} + \hat{k}$ and position vector $\vec{r} = 5\hat{i} - 6\hat{j} + 6\hat{k}$

1) $6\hat{i} + 2\hat{j} - 3\hat{k}$
2) $-18\hat{i} - 13\hat{j} + 2\hat{k}$
3) $18\hat{i} + 13\hat{j} - 2\hat{k}$
4) $6\hat{i} - 2\hat{j} + 8\hat{k}$

Q.8) The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectiles is:

1) $\theta = \tan^{-1}\left(\dfrac{1}{4}\right)$
2) $\theta = \tan^{-1}(4)$
3) $\theta = \tan^{-1}(2)$
4) $\theta = 45°$

Q.9) A particle of mass m is projected with velocity v making an angle of 45° with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be:

1) 2mv
2) $mv/\sqrt{2}$
3) $mv\sqrt{2}$
4) zero

Q.10) A stone tied with a string, is rotated in a vertical circle. The minimum speed with which the string has to be rotated.

1) is independent of the mass of the stone.

2) is independent of the length of the string.

3) decreases with increasing mass of the stone

4) decreases with increasing length of the string.

Q.11) **One end of string of length** ℓ **is** connected to a particle of mass 'm' and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed 'v' the net force on the particle (directed towards centre) will be (T represents the tension in the string):

1) $T + \dfrac{mv^2}{\ell}$

2) $T - \dfrac{mv^2}{\ell}$

3) zero

4) T

Q.12) Three blocks A, B and C of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block then the contact force between A and B is
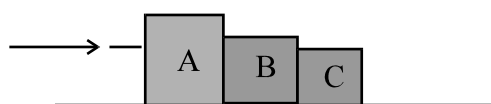
1) 6 N   2) 8 N

3) 18 N   4) 2N

Q.13) A monkey is decending from the branch of a tree with constant acceleration. If the breaking strength is 75% of the weight of the monkey, the minimum acceleration with which monkey can slide down without breaking the branch is

1) g   2) $\dfrac{3g}{4}$

3) $\dfrac{g}{4}$ 4) $\dfrac{g}{2}$

Q.14) A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45°, the speed of the car is:

1) 20 ms^{-1} 2) 30 ms^{-1}

3) 5 ms^{-1} 4) 10 ms^{-1}

Q.15) A particle of mass M is moving in a horizontal circle of radius R with uniform speed V. When it moves from one point to a diametrically opposite point, its

1) kinetic energy changes by MV^2/4

2) momentum does not change

3) momentum changes by 2 MV

4) kinetic energy changes by MV^2

Q.16) A body projected vertically from the earth reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force is greatest

1) at the highest position of the body

2) at the instant just before the body hits the earth.

3) it remains constant all through

4) at the instant just after the body is projected

Q.17) A body of mass (4m) is lying in x- y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is:

1) mv^2

2) $\dfrac{3}{2}$mv^2

3) 2 mv^2

4) mv^2

Q.18) Two identical balls A and B moving with velocities + 0.5 m/s and –0.3 m/s respectively, collides head on elastically . The velocities of the balls A and B after collision, will be, respectively

1) +0.5 m/s and +0.3 m/s

2) –0.3 m/s and + 0.5 m/s

3) +0.3 m/s and +0.5 m/s

4) –0.5 m/s and + 0.3 m/s

Q.19) A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is
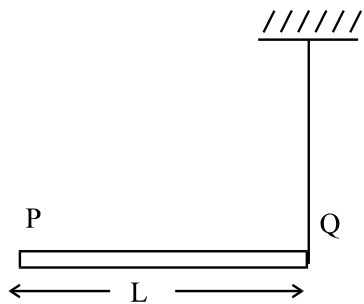
1) $g\!\!\diagup\!\!L$

2) $2g\!\!\diagup\!\!L$

3) $\dfrac{2g}{3L}$

4) $\dfrac{3g}{2L}$

Q.20) A circular platform is mounted on a frictionless vertical axle. Its radius R = 2m and its moment of inertia about the axle is 200 kgm^2. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of 1 ms^{-1} relative to the ground. Time taken by the man to complete one revolution is

1) πs

2) $\dfrac{3\pi}{2}$s

3) 2πs

4) $\dfrac{\pi}{2}$s

Q.21) A thin circular ring of mass M and radius r is rotating about its axis with a constant angular velocity ω. Four objects each of mass m, are kept gently to the opposite ends of two perpendicular diameters of the ring. The angular velocity of the ring will be

1) $\dfrac{(M-4m)\omega}{M+4m}$

2) $\dfrac{M\omega}{4m}$

3) $\dfrac{M\omega}{M+4m}$

4) $\dfrac{(M+4m)\omega}{M}$

Q.22) A constant torque of 1000N- m turns a wheel of moment of inertia 200 kg-m^2 about an axis through its centre. Its angular velocity after 3 seconds is

1) 1 rad/s

2) 5 rad/s

3) 10 rad/s

4) 15 rad/s

Q.23) The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its midpoint and perpendicular to its length is I$_0$. Its moment of inertia about an axis passing through one of its ends and perpendicular to its length is

1) $I_0 + ML^2/2$

2) $I_0 + ML^2/4$

3) $I_0 + 2ML^2$

4) $I_0 + ML^2$

Q.24) A drum of radius R and mass M, rolls down without slipping along an inclined plane of angle θ. The frictional force

1) dissipates energy as heat

2) decreases the rotational motion

3) decreases the rotational and translational motion

4) converts translational energy to rotational energy.

Q.25) A particle of mass M is situated at the centre of spherical shell of mass M and radius a. The magnitude of the gravitational potential at a point situated at a/2 distance from the centre will be

1) $\dfrac{2GM}{a}$ 2) $\dfrac{3GM}{a}$

3) $\dfrac{4GM}{a}$ 4) $\dfrac{GM}{a}$

Q.26) A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass $=5.98\times10^{24}$ kg) have to be compressed to be a black hole?

1) 10^{-9}m   2) 10^{-6} m

3) 10^{-2} m   4) 100m

Q.27) A planet is moving in an elliptical orbit around the sun. If T,V, E and L stand respectively for its kinetic energy, gravitational potential energty total energy and magnitude of angular momentum about the centre which of the following is correct?

1) T is conserved

2) V is always positive

3) E is always negative

4) L is conserved but direction of vector L changes continuously.

Q.28) When an elastic material with Young's modulus Y is subjected to stretching stress S, elastic energy stored per unit volume of the material is

1) $\dfrac{YS}{2}$ 2) $\dfrac{S^2 Y}{2}$

3) $\dfrac{S^2}{2Y}$ 4) $\dfrac{S}{2Y}$

Q.29) A wind with speed 40 m/s blows parallel to the roof of a house. The area of the roof is 250m². Assuming that the pressure inside the house is atmosphere pressure, the force exerted by the wind on the roof and the direction of the force will be

$$\left(\rho_{air} = 1.2\,kg/m^3)\right)$$

1) $4.8\times10^5\,N$, upwards

2) $2.4\times10^5\,N$, upwards

3) $2.4\times10^5\,N$, downwards

4) $4.8\times10^5\,N$, downwards

Q.30) A fluid is in streamline flow across a horizontal pipe of variable area of cross section. For this which of the following statements is correct?

1) The velocity is minimum at the narrowest part of the pipe and the pressure is minimum at the widest part of the pipe.

2) The velocity is maximum at the narrowest part of the pipe and pressure is maximum at the widest part of the pipe.

3) Velocity and pressure both are maximum at the narrowest part of the pipe

4) Velocity and pressure both are maximum at the widest part of the pipe

Q.31) The two ends of a rod of length L and a uniform cross - sectional area A are kept at two temperatures T_1 and T_2 ($T_1 > T_2$). The rate heat transfer, $\dfrac{dQ}{dt}$ through the rod in a steam state is given by:

1) $\dfrac{dQ}{dt} = \dfrac{k(T_1 - T_2)}{LA}$

2) $\dfrac{dQ}{dt} = kLA(T_1 - T_2)$

3) $\dfrac{dQ}{dt} = \dfrac{kA(T_1 - T_2)}{L}$

4) $\dfrac{dQ}{dt} = \dfrac{kL(T_1 - T_2)}{A}$

Q.32) A beaker full of hot water is kept in a room. If it cools from 80°C to 75°C in t_1 minutes, from 75°C to 70°C in t_2 minutes and from 70°C to 65°C in t_3 minutes, then

1) $t_1 = t_2 = t_3$

2) $t_1 < t_2 = t_3$

3) $t_1 < t_2 < t_3$

4) $t_1 > t_2 > t_3$

Q.33) In which of the following process, heat is neither absorbed nor released by a system?

1) isothermal   2) Adiabatic

3) isobaric   4) isochoric

Q.34) An ideal gas is compressed to half its initial volume by means of several processes. Which of the process results in the maximum work done on the gas?

1) Isobaric   2) Isochoric

3) Isothermal   4) Adiabatic

Q.35) In thermodynamic processes which of the following statements is not true?

1) In an isochoric process pressure remains constant

2) In an isothermal process the temperature remains constant

3) In a adiabatic process $PV^\gamma = \text{cons}\tan t$

4) In an adiabatic process the system is insulated from the surroundings

Q.36) Two carnot engines A and B are operated in series. The engine A receives heat from the source at **temperature T_1** and rejects the heat to the sink at temperature T. The second engine B receives the heat at temperature T and rejects to its sink at temperature T_2. For what value of T the efficiencies of the two engines are equal?

1) $\dfrac{T_1 + T_2}{2}$ 2) $\dfrac{T_1 - T_2}{2}$

3) $T_1 T_2$ 4) $\sqrt{T_1 T_2}$

Q.37) The ratio of the specific heats $\dfrac{C_P}{C_v} = \gamma$ in terms of degrees of freedom (n) is given by

1) $\left(1 + \dfrac{n}{3}\right)$

2) $\left(1 + \dfrac{2}{n}\right)$

3) $\left(1 + \dfrac{n}{2}\right)$

4) $\left(1 + \dfrac{1}{n}\right)$

Q.38) The equation of a simple harmonic wave is given by

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

Where x and y are in meters and t is in seconds. The ratio of maximum particle velocity to the wave velocity is

1) 2π

2) $\frac{3}{2}\pi$

3) 3π

4) $\frac{2}{3}\pi$

Q.39) In a simple harmonic motion, when the displacement is one- half the amplitude, what fraction of the total energy is kinetic?

1) 0

2) $\frac{1}{4}$

3) $\frac{1}{2}$

4) $\frac{3}{4}$

Q.40) A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 from the mean position are V_1 and V_2, respectively. Its time period is

1) $2\pi\sqrt{\dfrac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$

2) $2\pi\sqrt{\dfrac{V_1^2 + V_2^2}{x_1^2 - x_2^2}}$

3) $2\pi\sqrt{\dfrac{V_1^2 - V_2^2}{x_1^2 - x_2^2}}$

4) $2\pi\sqrt{\dfrac{x_1^2 - x_2^2}{V_1^2 - V_2^2}}$

Q.41) The amplitude of a pendulum executing simple harmonic motion falls to $\frac{1}{3}$ the original value after 100 oscillations. The amplitude falls to S times the original value after 200 oscillations, where S is

1) $\frac{1}{9}$

2) $\frac{1}{2}$

3) $\frac{2}{3}$

4) $\frac{1}{6}$

Q.42) The damping force on an oscillator is directly proportional to the velocity. The unit of the constant of proportionality is:

1) $kgms^{-1}$

2) $kgms^{-2}$

3) kgs^{-1}

4) kgs

Q.43) A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2 the ratio λ_2/λ_1 is

1) $\sqrt{\dfrac{m_1}{m_2}}$

2) $\sqrt{\dfrac{m_1 + m_2}{m_2}}$

3) $\sqrt{\dfrac{m_2}{m_1}}$

4) $\sqrt{\dfrac{m_1 + m_2}{m_1}}$

Q.44) If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided then the original fundamental frequency n of the string is given by:

1) $\dfrac{1}{n} = \dfrac{1}{n_1} + \dfrac{1}{n_2} + \dfrac{1}{n_3}$

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

3) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

4) $n = n_1 + n_2 + n_3$

Q.45) 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:

1) 4 beats per second with intensity ratio 25 : 16 between waxing and waning.

2) 8 beats per second with intensity ratio 25 : 16 between waxing and waning.

3) 8 beats per second with intensity ratio 81 : 1 between waxing and waning

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

CHEMISTRY

Q.46) The principal quantum number of an atom is related to the

1) Size and energy of the orbitals (shells)

2) Spin angular momentum

3) Orbital angular momentum

4) Orientation of the orbitals in space

Q.47) The velocity of electron in the second orbit of He^+ will be

1) 2.18×10^6 m/s

2) 1.09×10^6 m/s

3) 4.36×10^6 m/s

4) None

Q.48) The minium number of orbitals possible for a shell containing g-subshell is

1) 25   2) 9

3) 36   4) None of these

Q.49) 20 ml of 0.2 M $Al_2(SO_4)_3$ is mixed with 20ml of 0.6M $BaCl_2$. Concentration of Al^{3+} ion in the solution will be

1) 0.2M   2) 10.3M

3) 0.1M   4) 0.25M

Q.50) The rate of diffusion of two gases x and y is in the ratio of 1 : 5 and that of y and z in the ratio of 1 : 6. The ratio of the rate of diffusion of Z with respect to x is

1) 5 : 6   2) 1 : 30

3) 6 : 5   4) 30 : 1

Q.51) The circulation of blood in human body supplies O_2 and releases CO_2. The concentration of O_2 and CO_2 is variable but on an average, 100 ml blood contains 0.02 g of O_2 and 0.08 g of CO_2. The volume of O_2 and CO_2 at 1 atm and at body temperature 37^0C, assuming 10L blood in human body, is

1) 2 L, 4 L

2) 1.5 L, 4.5 L

3) 1.59 L, 4.62 L

4) 3.82 L, 4.62 L

Q.52) The equilibrium,

$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$, is attained at 25^0C in a closed container and an inert gas He is introduced at constant volume. Which of the following statement is correct ?

1) Concentration of PCl_5, PCl_3 and Cl_2 are changed

2) More Cl_2 is formed

3) Concentration of PCl_3 is reduced

4) The equilibrium remains undisturbed

Q.53) In a system, $A(s) \rightleftharpoons 2B(g) + 3C(g)$

If the conc. of C at equilibrium is increased by a factor of 2 (made twice), it will cause the equilibrium concentration of B to change to

1) two times the original value

2) one half of its original value

3) $2\sqrt{2}$ times the original value

4) $1/2\sqrt{2}$ times the original value

Q.54) Which of the following pairs have different bond order ?

1) CO and N_2 2) O_2^{2-} and F_2

3) NO⁻ and CN⁻   4) H_2 and He_2^{2+}

Q.55) The pair of species having identical shape is :

1) CF_4, SF_4 2) PCl_3, BF_3

3) XeF_2, CO_2 4) PF_5, IF_5

Q.56) Total number of isomers possible for C_4H_8 are _____.

1) 4   2) 3

3) 2   4) 6

Q.57) Match the species given in Column-I with the properties mentioned in Column - II

Column I	Column II
Species	Properties
i) BF_4^-	a) oxidation state of central atom is +4
ii) AlCl3	b) strong oxidising agent
iii) SnO	c) Lewi's acid
iv) PbO2	d) Can be further oxidised
	e) tetrahedral shape

1) i-c, ii-d, iii-b, iv-a

2) i-e, ii-c,d, iii-b, iv-a

3) i-a,e; ii-c, iii-d, iv-b

4) i-e, ii-c, iii-d, iv-a,b

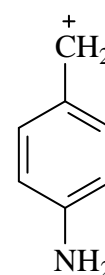Q.58) Arrange the following in order of decreasing order of their stability.
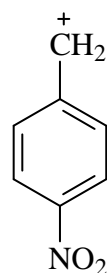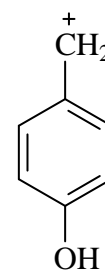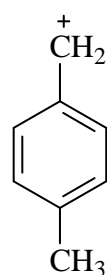

1) I > III > II > IV

2) IV > II > III > I

3) III > II > IV > I

4) IV > I > III > II

Q.59) In aniline, the -NH$_2$ group

1) activates the benzene ring via both inductive and resonance effects.

2) deactivates the benzene ring via both inductive and resonance effects.

3) activates the benzene ring via resonance effect and deactivates it via inductive effect.

4) activates the benzene ring via inductive effect and deactivates it via resonance effect.

Q.60) Which of the following structures correspond to the product expected, when excess of C_6H_6 reacts with CH_2Cl_2 in the presence of anhydrous $AlCl_3$?

1)

2)

3)

4)
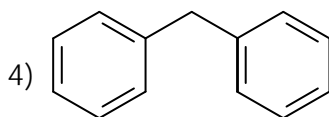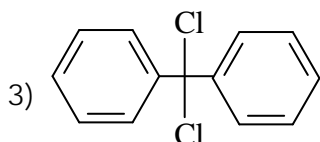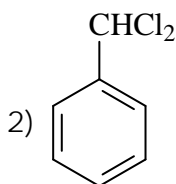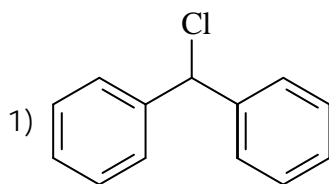
Q.61) Assertion (A): All the carbon atoms in $H_2C=C=CH_2$ are sp^2 hybridised

Reason (R): In this molecule all the carbon atoms are attached to each other by double bonds

1) Both A and R are correct and R is the correct explanation of A

2) Both A and R are correct but R is not the correct explanation of A

3) Both A and R are not correct

4) A is not correct but R is correct

Q.62) Nitrobenzene can be prepared from benzene by using a mixture of conc.HNO_3 and conc.H_2SO_4. In the nitrating mixture HNO_3 acts as a

1) base   2) acid

3) reducing agent 4) catalyst

Q.63) 1,2-dibromopropane on treatment with X moles of $NaNH_2$ followed by treatment with ethyl bromide gave a pentyne, the value of X is

1) one   2) two

3) three   4) four

Q.64) Reductive ozonolysis of 2,3-dimethylbut-1-ene gives

1) methanoic acid and 3-methyl-2-butanone

2) methanal and 3-methyl-2-butanone

3) methanal and 2-methyl-3-butanone

4) methanoic acid and 2-methyl-3-butanone

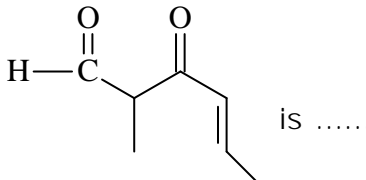Q.65) Dehydration of 1-butanol gives 2-butene as a major product, by which of the following final intermediate the compound 2-butene is obtained.

1)

2)

3)

4)
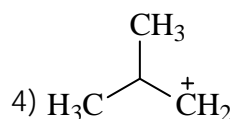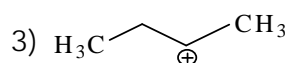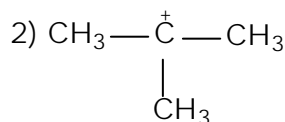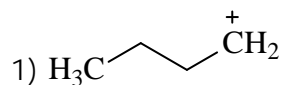
Q.66) When 22.4L of $H_2(g)$ is mixed with 11.2L of $Cl_2(g)$, each at STP, the moles of HCl(g) formed is equal to

1) 1mole of HCl(g)

2) 2 moles of HCl(g)

3) 0.5 mole of HCl(g)

4) 1.5 moles of HCl(g)

Q.67) An element X has the following isotopic composition :

^{200}X : 90%, ^{199}X :8.0%, ^{202}X :2.0%

The weighted average atomic mass of the naturally occurring element X is closest to

1) 201 u   2) 202 u

3) 199 u   4) 200 u

Q.68) If uncertainty in position and momentum are equal, then uncertainty in velocity is

1) $\dfrac{1}{2m}\sqrt{\dfrac{h}{\pi}}$ 2) $\sqrt{\dfrac{h}{2\pi}}$

3) $\dfrac{1}{m}\sqrt{\dfrac{h}{\pi}}$ 4) $\sqrt{\dfrac{h}{\pi}}$

Q.69) The maximum number of electrons in a subshell is given by the expression :

1) $4l-2$ 2) $4l+2$

3) $2l+2$ 4) $2n^2$

Q.70) Which of the following species contains equal number of σ and $\pi-$ bonds ?

1) HCO_3^- 2) XeO_4

3) $(CN)_2$ 4) $CH_2(CN)_2$

Q.71) In which of the following, bond angle is maximum ?

1) NH_3 2) NH_4^+

3) PCl_3 4) SCl_2

Q.72) Equal masses of H_2, O_2 and methane have been taken in a container of volume V at temperature 27^{0}C in identical conditions. The ratio of the volumes of gases $H_2 : O_2 : CH_4$ would be

1) 8 : 16 : 1   2) 16 : 8 : 1

3) 16 : 1 : 2   4) 8 : 1 : 2

Q.73) The equilibrium constants of the following are

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

$N_2 + O_2 \rightleftharpoons 2NO$; K_2

$H_2 + \dfrac{1}{2}O_2 \rightarrow H_2O$; K_3

The equilibrium constant (K) of the reaction

$2NH_3 + \dfrac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O$, will be

1) $K_1 K_3^3 / K_2$ 2) $K_2 K_3^3 / K_1$

3) $K_2 K_3 / K_1$ 4) $K_2^3 K_3 / K_1$

Q.74) According to Le-Chatelier's principle, adding heat to a solid $\rightleftharpoons$ liquid equilibrium will cause the

1) temperature to increase

2) temperature to decrease

3) amount of liquid to decrease

4) amount of solid to decrease

Q.75) pH of a saturated solution of $Ba(OH)_2$ is 12. The value of solubility product K_{sp} of $Ba(OH)_2$ is

1) 3.3×10^{-7} 2) 5.0×10^{-7}

3) 4.0×10^{-6} 4) 5.0×10^{-6}

Q.76) The conjugate acid of NH_2^- is

1) N_2H_4 2) NH_4^+

3) NH_2OH 4) NH_3

Q.77) An organic compound contains 69% carbon and 4.8% hydrogen, the remainder being oxygen. The mass of carbondioxide and water produced when 0.2g of this substance is subjected to complete combustion are

1) 0.506CO_2 and 0.0864gH_2O

2) 1.242gCO_2 and 0.1906gH_2O

3) 0.4716gCO_2 and 0.0352gH_2O

4) 0.5412gCO_2 and 0.1296gH_2O

Q.78) Bond dissociation enthalpy of H_2, Cl_2 and HCl are 434, 242 and 431 kJmol^{-1} respectively. Enthalpy of formation of HCl is

1) 93 kJmol^{-1} 2) -245 kJmol^{-1}

3) -93 kJmol^{-1} 4) 245 kJmol^{-1}

Q.79) Considering entropy (S) as a thermodynamic parameter, the criterion for the spontaneity of any process is

1) $\Delta S_{system} + \Delta S_{surrounding} > 0$

2) $\Delta S_{system} - \Delta S_{surrounding} > 0$

3) $\Delta S_{system} > 0$

4) $\Delta S_{surrounding} > 0$

Q.80) Which of the following statements about hydrogen is incorrect ?

1) Hydrogen never acts as cation in ionic salts

2) Hydronium ion, H_3O^+ exists freely in solution

3) Dihydrogen does not act as a reducing agent

4) Hydrogen has three isotopes of which protium is the most common.

Q.81) Solubility of the alkaline earth's metal sulphate in water decreases in the sequence

1) Mg > Ca > Sr > Ba

2) Ca > Sr > Ba > Mg

3) Sr > Ca > Mg > Ba

4) Ba > Mg > Sr > Ca

Q.82) The structure of H_2O_2 is

1) planar   2) non-planar

3) spherical   4) linear

Q.83) Which of the following has largest size ?

1) Na

2) Na$^+$

3) Na$^-$

4) cannot be predicted

Q.84) Which one of the following atoms will have the smallest size ?

1) Mg   2) Na

3) Be   4) Li

Q.85) The stability of +1 oxidation state among Al, Ga, In and Tl increases in the sequence

1) Ga < In < Al < Tl

2) Al < Ga < In < Tl

3) Tl < In < Ga < Al

4) In < Tl < Ga < Al

Q.86) The oxidation states of sulphur in the anion SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follows the order

1) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

2) $S_2O_6^{2-} < S_2O_4^{2-} < SO_3^{2-}$

3) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$

4) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$

Q.87) The IUPAC name of the compound

is ......

1) 2 Methyl- 3 Oxohex- 4- enal

2) 5-formylhex-2-en-3-one

3) 5-methyl-4-oxohex-2-en-5-al

4) 3-keto-2-methylhex-5-enal

Q.88) Which of the following reactions is an example of nucelophilic substitution reaction ?

1) $RX + KOH \rightarrow ROH + KX$

2) $2RX + 2Na \rightarrow R - R + 2NaX$

3) $RX + H_2 \rightarrow RH + HX$

4) $RX + Mg \rightarrow RMgX$

Q.89) 6.125g sample of $KClO_3$ on thermal decomposition gives 2.232g O_2 gas. Percentage purity of $KClO_3$ is

1) 90%   2) 91%

3) 92%   4) 93%

Q.90) Identify C in the following reaction

$$\xrightarrow[\text{2.}H_2O_2/\overset{-}{OH}]{\text{1.}BH_3,THF} B \xrightarrow[\Delta]{HF} C$$

1)

2)

3)

4)
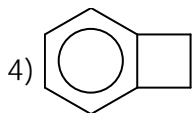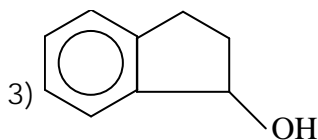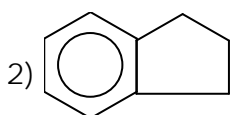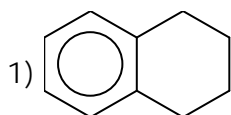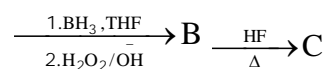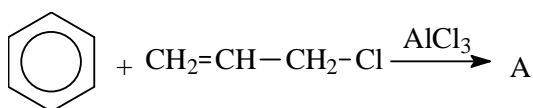
BIOLOGY

Q.91) Select the incorrect statement about living processes.

1) All living phenomena is due to underlying interaction

2) Properties of tissues are not present in the constituent cells

3) Properties of cellular organelles are present in the molecular constituents of the organelles

4) The interactions result in emergent properties at a higher level of organisation

Q.92) The Title 'Alexander Agassiz Professor of Zoology Emeritus' goes to

1) P. Maheshwari   2) R. Mishra

3) E. Mayr

4) G.N. Ramachandran

Q.93) Recognise the following flow diagram and find the correct option according to taxonomic hierarchy
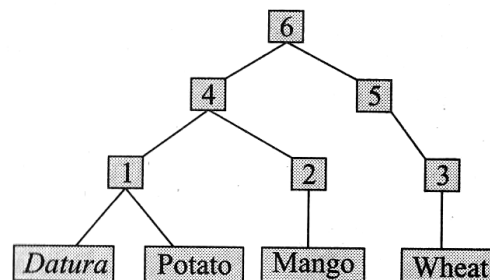
1) 1-Sapindales, 2-Polymoniales, 3-Poales, 4-Dicotyledonae, 5-Monocotyledonae, 6-Angiospermae

2) 1-Anacardiaceae, 2-Solanaceae, 3-Poaceae, 4-Polymoniales, 5-Poales, 6-Angiospermae

3) 1-Solanum, 2-Mangifera, 3-Triticum, 4-Dicotyledonae, 5-Monocotyledonae, 6-Plantae

4) 1-Sapindales, 2-Polymoniales, 3-Poales, 4-Angiospermae, 5-Monocotyledonae, 6- Plantae

Q.94) Which is incorrect about phycomycetes?

1) Mycelium is aseptate and coenocytic

2) A zygospore is formed by fusion of gametes

3) Asexual reproduction takes place by motile aplanospores and non-motile zoospores

4) White spots seen on mustard leaves are due to parasitic fungus Albugo

Q.95) Orange rot is caused by

1) Virus   2) Prions

3) Fungi   4) Viroids

Q.96) Match the columns I and II, and choose the correct combination from the options given

	Column I		Column II
	(Types of spore)		(Production)
a)	Zoospores	1	Exogenous
b)	Aplanospores	2	Endogenous
c)	Conidia		
d)	Ascospores		
e)	Basidiospores		

1) a-1,b-2,c-1,d-2,e-1

2) a-2,b-1,c-2,d-1,e-2

3) a-2,b-2,c-1,d-2,e-1

4) a-1,b-2,c-1,d-2,e-1

Q.97) Which human pathogen is a flagellated protozoan?

1) Plasmodium   2) Euglena

3) Trypanosoma   4) Entamoeba

Q.98) Recognise the figure and find out the correct matching
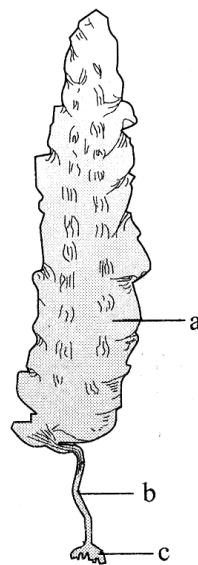
1) a-frond, b-stipe, c-holdfast

2) a-stipe, b-frond, c-holdfast

3) a-frond, b-holdfast, c-stipe

4) a-stipe, b-holdfast, c-frond

Q.99) Independent sporophyte is not found in

1) Bryophyta

2) Pteridophyta

3) Gymnosperm

4) Angiosperm

Q.100) Prothallus of fern produces

1) Gametes   2) Spores

3) Both 1 and 2   4) Gemma

Q.101) Which of the following is homosporous?

1) Selaginella   2) Salvinia

3) Cycas   4) Lycopodium

Q.102) Phylloclades are

    1) Leaf modification

    2) One internode long stems

    3) Modified petioles

    4) Green succulent stems of indefinite growth

Q.103) Match the columns I, II and III and choose the correct combination from the options given

	Column I		Column II		Column III
a)	If a pair of leaves arise at each node and lie opposite to each other	1	Alternate phyllotaxy	K	Alstonia
b)	If more than two leaves arise at a node	2	Opposite phyllotaxy	L	China rose
c)	If a single leaf arise at each node	3	Whorled phyllotaxy	M	Guava

    1) a-1-L,b-3-M,c-2-K

    2) a-2-M,b-1-N,C-3-K

    3) a-3-K,b-2-L,C-1-M

    4) a-2-M,b-3-K,C-1-L

Q.104) In monocotyledonous seeds, the embryo is small and situated in a groove at one end of the endosperm. It consists of one large and

    1) Bean shaped cotyledon known as Tigellum

    2) Kidney shaped cotyledon known as Scutellum

    3) Shield shaped cotyledon known as Scutellum

    4) Shield shaped cotyledon known as Tigellum

Q.105) In fabaceae, one of the following immediately encloses the essential organs

    1) Anterior petals

    2) Posterior petals

    3) Lateral petals

    4) Sepals

Q.106) Albuminous cells occur in

    1) Xylem

    2) Phloem

    3) Cortex

    4) Conjuctive parenchyma

Q.107) In roots, lateral branches grow from

    1) Epiblema   2) Pericycle

    3) Cortex   4) Endodermis

Q.108) Which of the following layer in dicot stem provides mechanical strength to the young stem?

    1) Epidermis   2) Hypodermis

    3) Endodermis   4) Cortical layer

Q.109) In dicot stems, the cells of cambium present between primary xylem and primary phloem are called

    1) Intrafascicular cambium

    2) Interfascicular cambium

    3) Cork cambium

    4) Vascular cambium

Q.110) A major characteristic of the monocot root is the presence of

    1) Vasculature without cambium

    2) Cambium sandwiched between phloem and xylem along the radius

    3) Open vascular bundles

    4) Scattered vascular bundles

Q.111) Lysosomal enzymes are active at pH

1) 5

2) 7

3) 8

4) 9

Q.112) A major site for synthesis of lipids is

1) Symplast

2) Nucleoplasm

3) RER

4) SER

Q.113) Reserve material in prokaryotic cells are stored in the cytoplasm in the form of

1) Pyrenoid

2) Paramylum bodies

3) Inclusion bodies which are bounded by single membrane

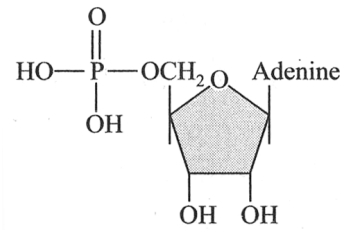4) Inclusion bodies which are not bounded by any membrane system

Q.114) Number of microtubules in the basal body of eukaryotic flagella and centrosome of animal cell respectively are

1) 27 & 54

2) 20 & 27

3) 20 & 54

4) 9 & 27

Q.115) Pick out lectin from those given below

1) Gum

2) Diterpene

3) Concanavalin A

4) Curcumin

Q.116) Recognise the figure and find out the correct statement

1) This compound is a nucleoside called adenosine

2) This compound is a nucleoside called adenylic acid

3) This compound is a nucleotide called adenosine

4) This compound is a nucleotide called adenylic acid

Q.117) Starch and cellulose are

1) Branched polysaccharides

2) Storage products

3) Components of plant cell walls

4) Composed of glucose

Q.118) Enzymes catalysing the removal of groups and formation of double bonds are

1) Transferases

2) Ligases

3) Lyases

4) Oxidoreductases

Q.119) If a cell possesses twice as much DNA as in the functional cell, the cell

1) is preparing to divide

2) has completed division

3) has ceased to function

4) has reached end of its life span

Q.120) Shape of chiasmata is

1) C-shaped

2) X-shaped

3) Y-shaped

4) U-shaped

Q.121) In meiosis centromere divides during

1) Prophase I　　2) Metaphase I

3) Anaphase I　　4) Anaphase II

Q.122) Tetrad is made up of

1) Four homologous chromosomes with four chromatids

2) Two homologous chromosomes, each with two chromatids

3) Four non-homologous chromatids

4) Four non-homologous chromosomes

Q.123) Consider the following statements and identify the correct option :

Statement I : During cellular respiration, the energy of oxidation - reduction reactions are utilised for the production of proton gradient required for phosphorylation.

Statement II : During oxidative phosphorylation, for each ATP produced, 2H$^+$ passes through F$_0$ from the matrix to the intermembrane space down the electrochemical proton gradient

1) Both the statements are true

2) Both the statements are false

3) Only statement II is false

4) Only statement I is false

Q.124) Long distance transport of water, minerals and food is generally carried out by

1) Diffusion only

2) Active transport only

3) Bulk flow system or mass flow system

4) Cytoplasmic streaming supplemented by active transport

Q.125) Water column does not rupture during ascent of sap in tracheary elements due to

1) Weak gravitational pull

2) Transpiration pull

3) Lignified thick walls

4) Cohesion and adhesion

Q.126) Common character between guard cells and mesophyll cells is

1) Dumbbell shaped

2) Differentially thick walls

3) Presence of chloroplasts

4) Uniformly thin cell wall

Q.127) The two sub-units of ribosome remain united at a critical ion level of

1) Magnesium　　2) Calcium

3) Copper　　　　4) Manganese

Q.128) Match column I and column II and choose the correct combination

	Column I		Column II
a)	Sulphur	1	Chlorophyll
b)	Zinc	2	Nitrogenase
c)	Magnesium	3	Methionine
d)	Molybdenum	4	Auxin

1) a-1,b-2,c-3,d-4

2) a-3,b-4,c-1,d-2

3) a-2,b-4,c-1,d-3

4) a-4,b-3,c-2,d-1

Q.129) Deficiency symptoms of nitrogen and potassium are visible first in

1) Buds

2) Senescent leaves

3) Young leaves   4) Roots

Q.130) Non-cyclic photophosphorylation produces

1) NAD^+ 2) NADH

3) NADPH   4) $NADP^+$

Q.131) How many of the following compounds contains 2 carbon, 3 carbon and 4 carbon respectively :

[Aspartic acid, Oxalo acetic acid, Acetyl Co.A, Pyruvic acid, Succinic acid, Phosphoenol pyruvic acid, Phospho glyceric acid, Phosphoglycolic acid]

1) 3 : 3 : 2   2) 2 : 2 : 4

3) 1 : 4 : 3   4) 2 : 3 : 3

Q.132) In C_4 pathway, CO_2 fixation in mesophyll cells is carried out by the enzyme

1) PEP carboxylase

2) Pyruvate dehydrogenase

3) RuBisCO

4) Pyruvate decarboxylase

Q.133) Plants showing C_4 photosynthesis have

1) Granal bundle sheath chloroplasts and agranal mesophyll chloroplasts

2) Agranal bundle sheath chloroplasts and granal mesophyll chloroplasts

3) Both bundle sheath and mesophyll chloroplasts are agranal

4) Both the types of chloroplasts are granal

Q.134) FAD is electron acceptor during oxidation of

1) α-Ketoglutarate $\rightarrow$ Succinyl CoA

2) Succinic acid $\rightarrow$ Fumaric acid

3) Succinyl CoA $\rightarrow$ Succinic acid

4) Fumaric acid $\rightarrow$ Malic acid

Q.135) Consider the following statements :

Statement I : Mitochondria is essential for aerobic respiration in all organisms

Statement II : Wherever aerobic respiration occur, there is abundanace of mitochondria

1) Both the statements are false

2) Both the statements are true

3) Only statement I is true

4) Only statement II is true

Q.136) How many type of proton pumps are present in chloroplast :

1) One   2) Two

3) Three   4) Four

Q.137) Parthenocarpy can be achieved by

1) Zeatin   2) ABA

3) Auxin   4) Kinetin

Q.138) At the time of seed germination, digestive enzymes are induced to be formed under the influence of

1) Cytokinin

2) Gibberellins

3) Ethylene

4) Auxin

Q.139) N^6 -furfuryl amino purine; 2, 4-dichloro-phenoxy acetic acid and indole 3-acetic acid are

1) Synthetic auxin, kinetin and natural auxin

2) Gibberellin, natural auxinand kinetin

3) Natural auxin, kinetin and synthetic auxin

4) Kinetin, synthetic auxin and natural auxin

Q.140) A long day plant flowers only when it is exposed to

1) Red light

2) Light more than critical day length

3) Light equal to critical day length

4) Light less than critical day length

Q.141) Match the following list of animals with their level of organization and **choose the correct** sequence:

Column I		Column II
A) Organ level	p)	*Pheretima*
B) Cellular level	q)	*Fasciola*
C) Tissue level	r)	*Spongilla*
D) Organ system level	s)	*Obelia*

1) A - s, B - r, C - p, D - q

2) A - s, B - q, C - r, D - 1

3) A - q, B - s, C - r, D - p

4) A - q, B - r, C - s, D - p

Q.142) Which of the following groups of animals are triploblastic?

1) Annelida, Mollusca, Porifera

2) Arthropoda, Cnidaria, Annelida

3) Mollusca, Echinodermata, Annelida

4) Mollusca, Ctenophora, Arthropoda

Q.143) Which of the following terms describe human dentition?

1) Thecodont, Diphyodont, Homodont

2) Thecodont, Diphyodont, Heterodont

3) Pleurodont, Monophyodont, Homodont

4) Pleurodont, Diphyodont, Heterodont

Q.144) Match the following and select the **correct** option.

Column I		Column II
A) Cyclostomes	(i)	Hemichordata
B) Aves	(ii)	Urochordata
C) Tunicates	(iii)	Agnatha
D) *Balanoglossus*	(iv)	Pisces
E) Osteichthyes	(v)	Tetrapod

1) A - i, B - ii, C - iii, D - iv, E - v

2) A - ii, B - iii, C - iv, D - i, E - v

3) A - iii, B - v, C - ii, D - i, E - iv

4) A - iii, B - i, C - v, D - ii, E - iv

Q.145) Read the following statements and choose the **correct** option

(i) Aves are homoiothermous

(ii) Pinnae are present in mammals

(iii) Operculum is present in chondrichthyes

(iv) Skin of amphibians is dry and horny

(v) Open type of circulation is found in cyclostomes

1) (i) and (ii) are wrong

2) (ii), (iii) and (iv) are wrong

3) (i), (ii) and (iv) are wrong

4) (iii), (iv) and (v) are wrong

Q.146) Which of the following options correctly represents the lung conditions in asthma and emphysema, respectively?

1) Inflammation of bronchioles, Decreased respiratory surface

2) Increased number of bronchioles, Increased respiratory surface

3) Increased respiratory surface, Inflammation of bronchioles

4) Decreased respiratory surface, Inflammation of bronchioles

Q.147) Choose the **correctly** matched pair

Tissue	Location
1) Cartilage	- Dense irregular connective tissue
2) Tendon	- Specialized connective tissue
3) Areolar tissue	- Loose connective tissue
4) Adipose tissue	- Dense regular connective tissue

Q.148) Read the following statements and choose the **correct** answer.

I. Gap junctions cement adjacent cells together.

II. Areolar tissue contains fibroblasts, macrophages and mast cells

III. Tight junctions facilitate the cells to communicate with each other

IV. Adhering junctions help to stop substances from leaking across tissues

V. Cells of connective tissue except blood secrete fibres of structural proteins called collagen or elastin

1) I, II and III are wrong

2) I, III and IV are wrong

3) III and V are wrong

4) I, II and V are wrong

Q.149) Read the following five statements about epithelial tissue (A to E) and select the **correct** statements:

A) Columnar epithelium is found in the walls of blood vessels and air sacs of lungs

B) Epithelial tissue has a free surface, which faces either a body fluid or the outside environment

C) The columnar epithelium is composed of a single layer of tall and slender cells

D) Squamous epithelium is commonly found in ducts of glands and tubular parts of nephrons in kidneys

E) All cells in epithelium are held together with little intercellular matrix

1) A, D and E   2) B, C and E 3) A, C and D   4) A, B and D

Q.150) Match the items given in Column I with those in Column II and select the correct option given below:

Column I	Column II
a) Tricuspid valve	i) Between left atrium and left ventricle
b) Bicuspid valve	ii) Between right ventricle and pulmonary artery
c) Semilunar valve	iii) Between right atrium and right ventricle

1) a-iii, b - i, c - ii

2) a - i, b - iii, c - ii

3) a - i, b - ii, c - iii

4) a - ii, b - i, c- iii

Q.151) The path of impulse transmission during vision is correctly represented by :

a) Visual cortex

b) Bipolar cells

c) Optic nerve

d) Photoreceptor cells

e) Ganglion cells

1) c→a→d→b→e

2) d→b→c→e→a

3) a→d→b→c→e

4) d→b→e→c→a

Q.152) Match the items given in column I with those in column II and select the **correct** option given below

Column I (Function)	Column II (Part of Excretory System)
a) Ultrafiltration	i) Henle's loop
b) Concentration of urine	ii) Ureter
c) Transportation of urine	iii) Urinary bladder
d) Storage of urine	iv) Malpighian corpuscle
	v) Proximal convoluted tubule

1) a - iv, b - v, c - ii, d - iii

2) a - iv, b - i, c - ii, d - iii

3) a - v, b - i, c - iii, d - ii

4) a - v, b - iv, c - i, d - iii

Q.153) Select the **correct** statement given below with respect to *Periplaneta americana:*

1) The nervous system of cockroach consists of segmentally arranged ganglia joined by a pair of longitudinal connectives on the dorsal side.

2) There are 16 very long malpighian tubules present at the junction of midgut and hindgut

3) Grinding of food is carried out only by the mouth parts

4) Males bear a pair of short thread-like anal styles.

Q.154) The main digestive function of enterokinase is

1) conversion of casein into paracasein

2) conversion of pepsinogen into pepsin

3) conversion of trypsinogen into trypsin

4) stimulation of the gastric glands to secrete gastric juice

Q.155) Which of the following statements is **true** about human alimentary canal?

1) Fundic region of stomach opens into the first part of small intestine

2) The opening of the stomach into the duodenum is guarded by sphincter of Oddi.

3) Large intestine consists of caecum, ileum, colon and rectum.

4) Caecum is a small blind sac which hosts some symbiotic microorganisms.

Q.156) Match the entities of Column I with Column II and choose the right option from the codes given below.

Column I		Column II	
A	Cardiac sphincter	1	Hepato-pancreatic duct
B	Pyloric sphincter	2	Joins gall bladder to common bile duct
C	Sphincter of Oddi	3	Opening of stomach into duodenum
D	Cystic duct	4	Opening of oesophagus into stomach

1) $\dfrac{A\ B\ C\ D}{4\ 3\ 1\ 2}$ 2) $\dfrac{A\ B\ C\ D}{4\ 3\ 2\ 1}$

3) $\dfrac{A\ B\ C\ D}{3\ 4\ 1\ 2}$ 4) $\dfrac{A\ B\ C\ D}{2\ 1\ 3\ 4}$

Q.157) Carbohydrate digesting enzymes are absent in
1) Saliva
2) Succus entericus
3) Pancreatic juice
4) Gastric juice

Q.158) Match the following columns.

Column I		Column II	
A	pO_2 of alveoli	1	40 mm Hg
B	pO_2 of atmospheric air	2	95 mm Hg
C	pO_2 of deoxygenated blood	3	104 mm Hg
D	pO_2 of oxygenated blood	4	159 mm Hg

1) $\dfrac{A\ B\ C\ D}{2\ 4\ 1\ 3}$ 2) $\dfrac{A\ B\ C\ D}{3\ 4\ 1\ 2}$

3) $\dfrac{A\ B\ C\ D}{3\ 2\ 1\ 4}$ 4) $\dfrac{A\ B\ C\ D}{2\ 4\ 3\ 1}$

Q.159) Choose the **wrong** statement.

1) Solubility of CO_2 in blood is 20-25 times higher than that of O_2

2) The total volume of air accommodated in the lungs at the end of a forced inspiration is called the 'vital capacity'

3) O_2 can bind with haemoglobin in a reversible manner to form oxyhaemoglobin

4) The diffusion membrane is made of three major layers namely the thin squamous epithelium of alveoli, the endothelium of alveolar capillaries and the basement substance in between them.

Q.160) Which of the following consists of the exchange part of the respiratory system?

1) From external nostrils up to the alveoli

2) From external nostrils to terminal bronchioles

3) From trachea to terminal bronchioles

4) Alveoli and their ducts

Q.161) Find out the **wrong** statement.

1) The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere

2) Functional residual capacity includes ERV + RV

3) Solubility of the gases as well as the thickness of the membranes involved in diffusion are also some important factors that can affect the rate of diffusion.

4) A healthy man can inspire or expire approximately 4000 to 4600 mL of air per minute

Q.162) The correct descending order of percentage proportion of leucocytes in human blood is

1) Neutrophils → Basophils → Lymphocytes → Eosinophils → Monocytes

2) Neutrophils → Monocytes → Lymphocytes → Eosinophils → Basophils

3) Neutrophils → Lymphocytes → Monocytes → Eosinophils → Basophils

4) Neutrophils → Eosinophils → Basophils → Lymphocytes → Monocytes

Q.163) Erythroblastosis foetalis can be avoided by administering ...**a**... to the ...**b**... immediately after the delivery of the ...**c**...child.

1) a−Rh antibodies, b−child, c−first
2) a−Rh antibodies, b−mother, c−second

3) a−anti-Rh antibodies, b−mother, c−second

4) a−anti-Rh antibodies, b−mother, c−first

Q.164) Which one is the first heart sound?

1) Lub during closure of semilunar valves

2) Lub during closure of atrio-ventricular valves

3) Dub during closure of atrio-ventricular valves

4) Dub during closure of semilunar valves

Q.165) Consider the following statements A,B, C and D. State whether they are true (T) or false (F)

A) An excessive loss of fluid from the body stimulates the osmoreceptors which stimulate hypothalamus to release ADH or vasopressin from the neurohypophysis

B) Rennin converts angiotensionogen to angiotensin I

C) Aldosterone causes reabsorption of Na^+ ion and water from proximal parts of the tubule

D) Water reabsorption is minimum at proximal convoluted tubule

	A	B	C	D
1	T	F	F	F
2	T	T	F	F
3	F	F	F	T
4	T	F	T	F

Q.166) What is the osmolarity(in mO smolL^{-1}) in the outer cortex and inner medullary region?

1) 300 and 900 respectively

2) 600 and 300 respectively

3) 1200 and 300 respectively

4) 300 and 1200 respectively

Q.167) A fall in glomerular filtration rate (GFR) activates

1) Juxta glomerular cells to release renin

2) Adrenal cortex to release aldosterone

3) Adrenal medulla to release adrenaline

4) Posterior pituitary to release vasopressin

Q.168) **Which of the following is true** about Atrial Natriuretic Factor :

1) Peptide hormone

2) Increases blood pressure

3) Reduces blood pressure

4) Vaso constrictor

5) Cause vasodialation

1) 1, 2 and 4 are true

2) 1, 3 and 5 are true

3) 2 and 4 are true

4) 5 only is true

Q.169) What is the effect of Oxytocin produced by hypothalamus?

1) Stimulates the synthesis and secretion of androgens

2) Stimulates formation of milk in mammary glands

3) Stimulates a vigorous myometrial contraction at the time of childbirth.

4)Stimulates synthesis of carbohydrates from non-carbohydrates in liver

Q.170) Match the hormones secreted by various endocrine structures and choose the correct option

I. Hypothalamus	A. Melanocyte stimulating hormone
II. Pars intermedia	B. Aldosterone
III. Pineal gland	C. Gonadotrophin releasing hormone
IV. Adrenal medulla	D. Melatonin
V. Adrenal cortex	E. Catecholamines

1) I - E, II - A, III - D, IV - B, V - C

2) I - E, II - E, III - A, IV - B, V - C

3) I - B, II - D, III - A, IV - C, V - E

4) I - C, II - A, III - D, IV - E, V - B

Q.171) Which of the following is **incorrect** with reference to hypophysis?

1) It lies in a bony depression called sella tursica

2) Connected to hypothalamus through infundibulum

3) Anatomically divided into adeno-hypophysis and neurohypophysis

4) Neurohypophysis synthesises ADH and OT

Q.172) Which of the following is **not true** of hormones and target organs

1) PRL - Mammary gland

2) ACTH - Adrenal medulla

3) TSH - Thyroid gland

4) ICSH - Gonads

Q.173) Which of the following statement is **not** true regarding A - band?

1) Includes H-zone and M-line

2) Middle part contains M - line

3) Length remains constant during muscle contraction

4) Has thick filaments only

Q.174) Match the following:

a) Clavicle   1) Hind limb

b) Pubis   2) Patella

c) Knee cap   3) Pectoral girdle

d) Carpals   4) Pelvic girdle

e) Tarsals   5) Wrist

1) a - 3, b - 4, c - 2, d - 5, e - 1

2) a - 3, b - 4, c - 2, d - 1, e - 5

3) a - 1, b - 3, c - 2, d - 5, e - 4

4) a - 4, b - 5, c - 1, d - 2, e - 3

Q.175) An age related disorder characterised by decreased bone mass and increased chances of fractures

1) Gout

2) Osteoporosis

3) Rheumatoid arthritis

4) Osteoarthritis

Q.176) Given below is the diagram of pelvic girdle, part labelled 2 is
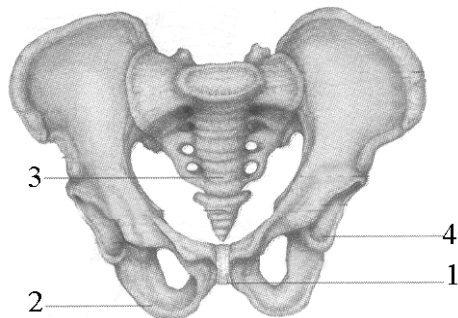
1) Pubic symphysis   2) Sacrum

3) Pubis   4) Ischium

Q.177) Find out the **incorrect** statement about skeletal muscle fibre

a) The thin filaments are firmly attached to the M line.

b) The A and I bands are arranged alternately throughout the length of the myofibril .

c) Muscle contraction is initiated by a signal sent by the central nervous system via a motor neuron.

d) Increase in Ca^{++} level in the sarcoplasm leads to the binding of calcium with a subunit of tropomyosin on actin filament

e) The portion of the myofibril between two successive Z lines is considered as the functional unit of contraction

1) d & e are incorrect

2) a & d are incorrect

3) b & d are incorrect

4) Only a is incorrect

Q.178) Which of the following parts is **incorrectly** paired with its function?

1) Medula oblongata	controls respiration and cardiovascular reflexes
2) Limbic system	consists of fibre tracts that interconnect different regions of brain, controls movement
3) Hypothalamus	production of releasing hormones and regulation of temperature, hunger and thirst
4) Corpus callosum	band of fibers connecting left and right cerebral hemispheres

Q.179) Consider following features:

(a) Organ system level of organisation

(b) Bilateral symmetry

(c) True coelomates with segmentation of body

Select the correct option of animal groups which possess all the above characteristics.

1) Annelida, Arthropoda and Chordata

2) Annelida, Arthropoda and Mollusca

3) Antropoda, Mollusca and Chordata

4) Annelida, Mollusca and Chordata

Q.180) If the head of cockroach is removed, it may live for few days because :

1) the supra- oesophageal ganglia of the cockroach are situated in ventral part of abdomen.

2) the cockroach does not have nervous system.

3) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.

4) the head holds 1/3rd of the nervous system while the rest is situated along the dorsal part of its body.

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03-06-2021	Batch : MEDICAL 2021	**Version**
REPEATERS NEET MODEL EXAM - UNIT I, II, III, IV, V		**A**
P+C+B- Key with Hints	Time: 3 hrs. Max. Mark: 720	

PHYSICS

1. 2   As we know that, surface tension(s) =

$\dfrac{\text{Force}[F]}{\text{Length}[L]}$

So, $[S] = \dfrac{[MLT^{-2}]}{[L]} = [MT^{-2}]$

Energy, $(E) = \text{Force} \times \text{Displacement}$,
$[E] = [ML^2T^{-2}]$

Velocity $(V) = \dfrac{\text{displacement}}{\text{time}}$

$[V] = [LT^{-1}]$

Let surface tension expressed as,
$s = E^a\, V^b\, T^c$ where a, b, c are constant.
Put the value

$\dfrac{[MLT^{-2}]}{[L]} = [ML^2T^{-2}]^a \left[\dfrac{L}{T}\right]^b [T]^c$

From the principle of homogeneity,
Equating the dimension of LHS and RHS
$[ML^0T^{-2}] = [M^a L^{2a+b} T^{-2a-b+c}]$
$\Rightarrow$ $a = 1,\ 2a + b = 0,\ -2a - b + c = -2$
$\Rightarrow$ $a = 1,\ b = -2,\ c = -2$
Hence, the dimensions of surface tension are
$[E\, V^{-2}\, T^{-2}]$

2. 4   Work = Force $\times$ displacement
$= [MLT^{-2}][L]$
$= [ML^2T^{-2}]$
Torque = Force $\times$ force arm
$\qquad$ = mass $\times$ acceleration $\times$ length
$\qquad$ = $[M] \times [LT^{-2}] \times [L] = [M\,L^2T^{-2}]$

3. 3   Percentage error in mass $\left(\dfrac{\Delta m}{m} \times 100\right) = 2$

and percentage error in speed $\left(\dfrac{\Delta v}{v} \times 100\right) = 3$.

Kinetic energy, $k = \dfrac{1}{2}mv^2$.

$\therefore$ Error in measurement of kinetic energy

$\dfrac{\Delta K}{K} = \dfrac{\Delta m}{m} + 2\left(\dfrac{\Delta v}{v}\right)$

$= \left(\dfrac{2}{100}\right) + \left(2 \times \dfrac{3}{100}\right) = \dfrac{8}{100} = 8\%$

$\therefore$ %age error = 8%.

4. 2   Given, $\vec{u} = 3\hat{i} + 4\hat{j}$ and $\vec{a} = 0.4\hat{i} + 0.3\hat{j}$
$\Rightarrow$ $u_x = 3$units, $u_y = 4$ units
$\Rightarrow$ $a_x = 0.4$ units, $a_y = 0.3$ units
Along x-axis,
$\therefore$ $v_x = u_x + a_x \times 10 = 3 + 4 = 7$ units
Along y-axis,
and $v_y = 4 + 0.3 \times 10 = 4 + 3 = 7$ units
Net final velocity

5. 2   distance, $s = at^2 - bt^3$

velocity, $v = \dfrac{ds}{dt} = 2at - 3bt^2$

acceleration $a = \dfrac{dv}{dt} = 2a - 6bt$
Acceleration is zero at

$2a - 6bt = 0$ $\Rightarrow$ $t = \dfrac{a}{3b}$

6. 3   Height of tap = 5m and $(g) = 10$ m/sec^2.

For the first drop, $S = ut + \dfrac{1}{2}gt^2$

$5 = (0 \times t) + \dfrac{1}{2} \times 10t^2 = 5t^2$ or $t^2 = 1$ or $t = 1$ sec.

It means that the third drop leaves after one second of the first drop. Or, each drop leaves after every 0.5 sec.
Distance covered by the second drop in 0.5 sec

$= ut + \dfrac{1}{2}gt^2 = (0 \times 0.5) + \dfrac{1}{2} \times 10 \times (0.5)^2$
$= 1.25$ m.

7. 2   As we know that
$\vec{v} = \vec{\omega} \times \vec{r} = (3\hat{i} - 4\hat{j} + \hat{k}) \times (5\hat{i} - 6\hat{j} + 6\hat{k})$
$\qquad = -18\hat{i} - 13\hat{j} + 2\hat{k}$

8.   **2**   Horizontal range,

$$R = \frac{u^2 \sin 2\theta}{g}$$

Maximum height,

$$H = \frac{u^2 \sin^2 \theta}{2g}$$

According to the condition,

$R = H$

$$\Rightarrow \quad \frac{u^2 \sin 2\theta}{g} = \frac{u^2 \sin^2 \theta}{2g}$$

$$\Rightarrow \quad 2 \sin \theta \cos \theta = \frac{\sin^2 \theta}{2}$$
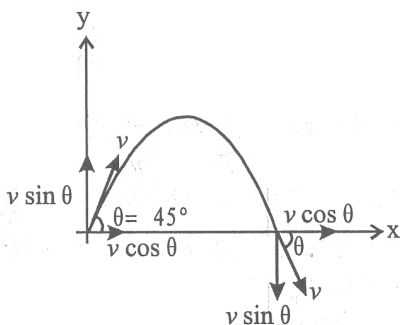
$$2 \cos \theta = \frac{\sin \theta}{2}$$

$$\Rightarrow \quad \cot \theta = \frac{1}{4}$$

$$\Rightarrow \quad \tan \theta = 4$$

$$\Rightarrow \quad \theta = [\tan^{-1}(4)]$$

9.   **3**   The momentum along *a*-axis remains unchanged

Clearly, change in momentum along *x*-axis = $mv \cos\theta - mv \cos\theta = 0$

Momentum changed only in vertical direction or *y*-axis.

So, $\Delta P = \Delta P_{vertical}$

$\Rightarrow \quad P_{final} = P_{initial}$

$= mv \sin\theta - (-mv \sin\theta)$

$= 2 \, mv\sin\theta = 2mv \times \sin 45°$

$= 2mv \times \frac{1}{\sqrt{2}} = \sqrt{2}mv$

Hence, resultant change in momentum $= \sqrt{2}mv$

10.   **1**   Minimum speed with which the string is rotating in a vertical circle (v) = $\sqrt{gr}$

The minimum speed of stone is independent of mass of stone.

11.   **4**   Net force on particle in uniform circular motion is centripetal force $\left(\frac{mv^2}{\ell}\right)$ which is provided by tension in string so the net force will be equal to tension *i.e.*, T.

12.   **1**   Acceleration of system, $a = \frac{F_{net}}{M_{total}}$

$$= \frac{14}{4+2+1} = \frac{14}{7} = 2 \, m/s^2$$
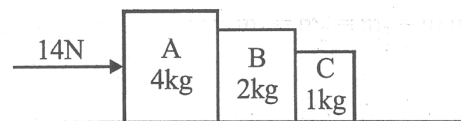
The contact force between A and B

$= (m_B + m_C) \times a = (2 + 1) \times 2 = 6N$

13.   **3**   Let T be the tension in the branch of a tree when monkey is descending with acceleration a. Then mg – $T = ma$; and $T = 75\%$ of weight of monkey,

$$\therefore \; ma = mg - \left(\frac{75}{100}\right) mg = \left(\frac{1}{4}\right) mg$$

or $a = \frac{g}{4}$.

14.   **2**   For banking, $\tan \theta = \frac{V^2}{Rg}$

$$\tan 45° = \frac{V^2}{90 \times 10} = 1$$

$$V = 30 \; m/s$$

15.   **3**   On the diametrically opposite points, the velocities have same magnitude but opposite directions. Therefore, change in momentum is $MV - (-MV) = 2MV$

16. 2   Power exerted by a force is given by

$P = F.v$

When the body is just above the earth's surface, its velocity is greatest. At this instant, gravitational force is also maximum. Hence, the power exerted by the gravitational force is greatest at the instant just before the body hits the earth.

17. 2

By conservation of linear momentum
Magnitude of the momentum of heavier piece of mass (2m) = Magnitude of the vector sum of momentum of each piece of mass (m)

$$(2m)v_1 = \sqrt{(mv)^2 + (mv)^2}$$

$$\Rightarrow \quad 2mv_1 = \sqrt{2}mv \Rightarrow v_1 = \frac{v}{\sqrt{2}}$$

As two masses of each of mass m move perpendicular to each other.
Total KE generated

$$= \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2}(2m)v_1^2$$

$$= mv^2 + \frac{mv^2}{2} = \frac{3}{2}mv^2$$

18. 2   When the identical balls collide head-on, their velocities are exchanged.

19. 4
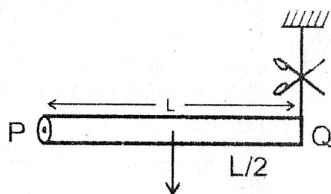
Weight of the rod will produce the torque

$$\tau = mg\frac{L}{2} = I\alpha = \frac{mL^2}{3}\alpha \quad \left[\because I_{rod} = \frac{ML^2}{3}\right]$$

Hence, angular acceleration, $\alpha = \dfrac{3g}{2L}$

20. 3   According to the conservation of angular momentum,
When no external torque acts on system, the angular momentum does not change.

$L_{system} = L_{man} + L_{platform} = $ constant

$L_{man} = -L_{platform}$

$L_{man} = mvR$

where m is mass of man, v is speed of man relative to ground, R is the radius of platform,

$L_{platform} = I\omega$

where I is moment of inertia, ω is angular velocity.

$$\Rightarrow \omega = \frac{L_{platform}}{I} = -\frac{L_{man}}{I} = \frac{-mvR}{I}$$

Speed of man relative to platform is

$$v_{platform} = v - \omega R = v + \frac{mvR}{I}R$$

$$= v\left[1 + \frac{mR^2}{I}\right]$$

Time taken by man to complete one revolution is,

$$t = \frac{2\pi R}{v_{platform}} = \frac{2\pi r}{v\left[1 + \dfrac{mR^2}{I}\right]} = 2 \times \frac{2}{1(1+1)}\pi$$

$$\Rightarrow \quad t = 2\pi \text{ second}$$

21. 3   Applying conservation law of angular momentum, $I_1\omega_1 = I_2\omega_2$

$I_2 = (Mr^2) + 4(m)(r^2) = (M + 4m)r^2$

(Taking $\omega_1 = \omega$ and $\omega_2 = \omega_1$)

$$\Rightarrow Mr^2\omega = (M + 4m)r^2\omega_1$$

$$\Rightarrow \omega_1 = \frac{M\omega}{M + 4m}$$

22. 4

$$\tau = 1000\,N\text{-}m, I = 200\,\text{kg-}m^2$$

$$\tau = I.\alpha \text{ and } \alpha = \left(\frac{\omega_f - \omega_0}{t}\right)$$

$$\Rightarrow \alpha = \frac{1000}{200} = 5\,\text{rad/sec}^2$$

$$\omega_1 = \omega_0 + \alpha t = 0 + 3 \times 5 = 15\,\text{rad/s}$$

23. 2   By theorem of parallel axes,

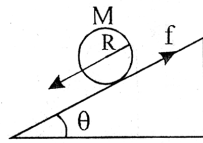$I = I_{cm} + Md^2$

$I = I_0 + M(L/2)^2 = I_0 + ML^2/4$

24. 4   Net work done by frictional force when drum rolls down without slipping is zero.

$$W_{net} = 0$$

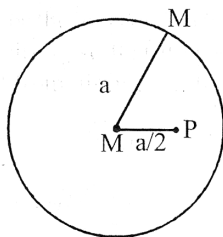$$W_{trans.} + W_{rot.} = 0; \quad \Delta K_{trans.} + \Delta K_{rot.} = 0$$
$$\Delta K_{trans} = -\Delta K_{rot.}$$

i.e., converts translation energy to rotational energy.

25. 2 $$V_P = V_{spherical\ shell} + V_{particle}$$

$$= \frac{GM}{a} + \frac{GM}{a/2} = \frac{3GM}{a}$$

At every point, inside a spherical shell of radius R, the gravitational potential is same as that on that surface of the shell, *i.e.*,

$$V = -\frac{GM}{R}$$

26. 3   From question,
Escape velocity

$$= \sqrt{\frac{2GM}{R}} = c = \text{speed of light}$$

$$\Rightarrow \quad R = \frac{2GM}{c^2}$$

$$= \frac{2 \times 6.6 \times 10^{-11} \times 5.98 \times 10^{24}}{(3 \times 10^8)^2} \text{ m}$$

$$= 10^{-2} \text{ m}$$

27. 3   In a circular or elliptical orbital motion, torque is always acting parallel to displacement or velocity. So, angular momentum is conserved. In attractive field, potential energy is negative. Kinetic energy changes as velocity increase when distance is less. So, option (c) is correct.

28. 3   Energy stored per unit volume

$$= \frac{1}{2} \times \text{stress} \times \text{strain}$$

$$= \frac{1}{2} \times \text{stress} \times (\text{stress/Young's modulus})$$

$$= \frac{1}{2} \times (\text{stress})^2/(\text{Young's modulus}) = \frac{S^2}{2Y}$$

29. 2   According to Bernoulli's theorem,

$$P + \frac{1}{2}\rho v^2 = P_0 + 0$$

So, $\Delta P = \frac{1}{2}\rho v^2$

$$F = \Delta PA = \frac{1}{2}\rho v^2 A$$

$$= \frac{1}{2} \times 1.2 \times 40 \times 40 \times 250$$

$$= 2.4 \times 10^5 \text{ N (upwards)}$$
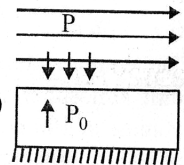
30. 2   According to Bernoulli's theorem,

$$P + \frac{1}{2}\rho v^2 = \text{constant and } Av = \text{constant}$$

If A is minimum, v is maximum, P is minimum.

31. 3 $$\frac{dQ}{dt} = \frac{kA(T_1 - T_2)}{L}$$

$[(T_1 - T_2)$ is the temperature difference]

Rate of heat flow is called heat current,

$$H = \frac{dQ}{dt} \text{ and } H = \frac{(T_1 - T_2)}{R}$$

and thermal resistance, $R = \dfrac{L}{kA}$

32. 3   Let θ_0 be the temperature of the surrounding. Then

$$\frac{80 - 75}{t_1} = k\left(\frac{80 + 75}{2} - \theta_0\right)$$

or, $\dfrac{5}{t_1} = k(77.5 - \theta_0)$

or, $t_1 = \dfrac{5}{k(77.5 - \theta_0)}$ ...(1)

Similarly, $t_2 = \dfrac{5}{k(72.5 - \theta_0)}$ ...(2)
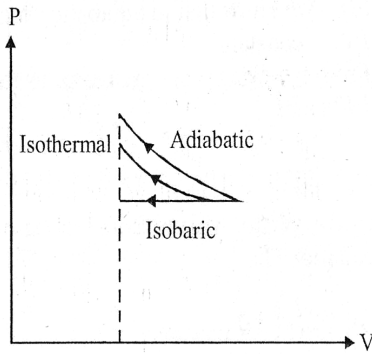
and $t_3 = \dfrac{5}{k(67.5 - \theta_0)}$ ...(3)

From (1), (2) & (3), it is obvious that
$t_1 < t_2 < t_3$

33. 2   In adiabatic process, there is no exchange of heat, with the surroundings.

34. 4

Since area under the curve is maximum for adiabatic process so, work done (W = PdV) on the gas will be maximum for adiabatic process.

35. 1   In an isochoric process volume remains constant whereas pressure remains constant in isobaric process.

36. 4   Efficiency of engine A, $\eta_1 = 1 - \dfrac{T}{T_1}$,

Efficiency of engine B, $\eta_2 = 1 - \dfrac{T_2}{T}$

Here, $\eta_1 = \eta_2$

$\therefore \dfrac{T}{T_1} = \dfrac{T_2}{T} \Rightarrow T = \sqrt{T_1 T_2}$

37. 2   Let 'n' be the degree of freedom

$$\gamma = \frac{C_p}{C_v} = \frac{\left(\dfrac{n}{2}+1\right)R}{\left(\dfrac{n}{2}\right)R} = \left(1 + \frac{2}{n}\right)$$

38. 2

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

$y = 3\sin\left(25\pi t - \dfrac{\pi}{2}x\right)$ on comparing with the standard wave equation
$y = a\sin(\omega t - kx)$

Wave velocity $v = \dfrac{\omega}{k} = \dfrac{25\pi}{\pi/2} = 50$ m/sec.

The velocity of particle

$$v_p = \frac{\partial y}{\partial t} = 75\pi \cos\left(25\pi t - \frac{\pi}{2}x\right)$$

$v_{p\,max} = 75\pi$

then $\dfrac{v_{p_{max}}}{v} = \dfrac{75\pi}{50} = \dfrac{3\pi}{2}$

39. 4   Total energy of particle executing S.H.M. of amplitude (A).

$$E = \frac{1}{2}m\omega^2 A^2$$

K.E. of the particle

$$= \frac{1}{2}m\omega^2\left(A^2 - \frac{A^2}{4}\right) \quad \left(\text{when } x = \frac{A}{2}\right)$$

$$= \frac{1}{2}m\omega^2 \times \frac{3}{4}A^2 = \frac{1}{2} \times \frac{3}{4}m\omega^2 A^2$$

Clearly, $\dfrac{KE}{\text{Total Energy}} = \dfrac{3}{4}$

40. 1   As we know, for particle undergoing SHM,

$$V = \omega\sqrt{A^2 - X^2}$$

$$V_1^2 = \omega^2(A^2 - x_1^2)$$

$$V_2^2 = \omega^2(A^2 - x_2^2)$$

Substracting we get,

$$\frac{V_1^2}{\omega^2} + x_1^2 = \frac{V_2^2}{\omega^2} + x_2^2$$

$$\Rightarrow \quad \frac{V_1^2 - V_2^2}{\omega^2} = x_2^2 - x_1^2$$

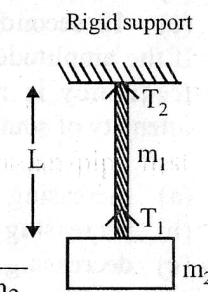$$\Rightarrow \quad \omega = \sqrt{\frac{V_1^2 - V_2^2}{x_2^2 - x_1^2}}$$

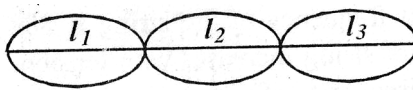$$\Rightarrow \quad T = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$$

41. **1** In harmonic oscillator, amplitude falls exponentially.

After 100 oscillations amplitude falls to $\dfrac{1}{3}$ times.

∴ After next 100 oscillations i.e., after 200 oscillations amplitude falls to $\left(\dfrac{1}{3}\right)^2 = \dfrac{1}{9}$ times.

42. **3** $F \propto v \Rightarrow F = kv$

$k = \dfrac{F}{v} \Rightarrow [k] = \dfrac{[\text{kgms}^{-2}]}{[\text{ms}^{-1}]} = \text{kgs}^{-1}$

43. **2** From figure, tension $T_1 = m_2g$

$T_2 = (m_1 + m_2)g$

As we know

Velocity $\propto \sqrt{T}$

So, $\lambda \propto \sqrt{T}$

$\Rightarrow \dfrac{\lambda_1}{\lambda_2} = \dfrac{\sqrt{T_1}}{\sqrt{T_2}}$

$\Rightarrow \dfrac{\lambda_2}{\lambda_1} = \sqrt{\dfrac{m_1 + m_2}{m_2}}$

Rigid support

44. **1**

$n = \dfrac{1}{2l}\sqrt{\dfrac{T}{m}}$

or, $n \propto \dfrac{1}{l}$ or $nl = $ constant, K

∴ $n_1 l_1 = K$,

$n_2 l_2 = K$, $n_3 l_3 = K$

Also, $l = l_1 + l_2 + l_3$

or, $\dfrac{K}{n} = \dfrac{K}{n_1} + \dfrac{K}{n_2} + \dfrac{K}{n_3}$

or, $\dfrac{1}{n} = \dfrac{1}{n_1} + \dfrac{1}{n_2} + \dfrac{1}{n_3}$

45. **4** $2\pi f_1 = 600\pi$

$f_1 = 300$ ...(1)

$2\pi f_2 = 608\pi$

$f_2 = 304$ ...(2)

$|f_1 - f_2| = 4$ beats

$\dfrac{I_{max}}{I_{min}} = \dfrac{(A_1 + A_2)^2}{(A_1 + A_2)^2} = \dfrac{(5+4)^2}{(5-4)^2} = \dfrac{81}{1}$

where A_1, A_2 are amplitudes of given two sound wave.

CHEMISTRY

46. **1** Principal quantum number is related to size and energy level of major shell

47. **1** Velocity of electron in the nth orbital of H-like atom is given by

$= 2.18 \times 10^6 \times \dfrac{Z}{n}\, \text{m/s}$

For second orbit of He^{2+} ion

Z = 2, n = 2

∴ Velocity of electron

$= 2.18 \times 10^6 \text{m/s}$

48. **1** For g- sub-shell value of 'n' is 5. So number of orbitals i.e. n^2. Thus $(5)^2 = 25$

49. **1**

$$Al_2(SO_4)_3 + 3BaCl_2 \rightarrow 3BaSO_4 \downarrow + 2AlCl_3$$

	$Al_2(SO_4)_3$	$3BaCl_2$	$3BaSO_4$	$2AlCl_3$
Initial Meq.	$20 \times 0.2 \times 6$ $= 24$	$20 \times 0.6 \times 2$ $= 24$	0	0
Final Meq.	0	0	24	24

$[Al^{3+}] = \dfrac{24}{40 \times 3} = 0.2M$
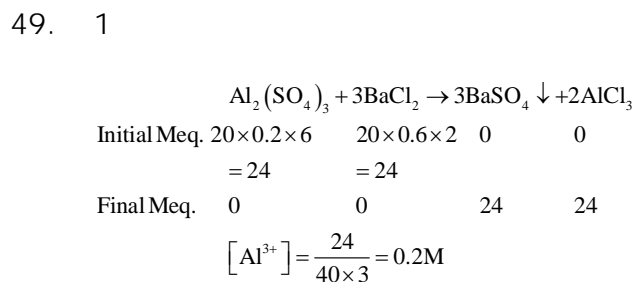
50. **4** $\dfrac{r_x}{r_y} = \dfrac{1}{5}$ and $\dfrac{r_y}{r_z} = \dfrac{1}{6}$

$\dfrac{r_z}{r_x} = \dfrac{30}{1}$

51. 3 $\because$ 100 ml blood has 0.02g O_2 and 0.08 g CO_2

$\therefore$ 10,000 ml blood has 2 g O_2 and 8 g CO_2

Using PV=nRT

For O_2, $1 \times V_{O_2} = \dfrac{2}{32} \times 0.0821 \times 310$

$\Rightarrow V_{O_2} = 1.59\,litre$

For CO_2, $1 \times V_{CO_2} = \dfrac{8}{44} \times 0.0821 \times 310$

$\Rightarrow V_{CO_2} = 4.62\,litre$

52. 4   Since decomposition of PCl_3 is carried out in a closed container. When helium gas is introduced the volume remains constant and there is no change in the partial pressure of PCl_5, PCl_3 and Cl_2. Therefore, nothing happens on introduction of helium gas at constant volume.

53. 4 $A(s) \rightleftharpoons 2B(g) + 3C(g)$
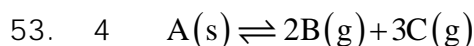
Let x and y be the concentration of B and C at equilibrium respectively.

$\therefore K_c = x^2 y^3 \dots\dots(1)$

Now, the concentration of C is changed from y to y' such that y'=2y. If x' is the new concentration of B

$\therefore K_c = (x')^2 (y')^3 = (x')^2 (2y)^3 \dots\dots(2)$

From eqs. (1) and (2)

$(x')^2 (8y^3) = x^2 y^3$

$\therefore x' = \sqrt{\dfrac{x^2}{8}} = \dfrac{x}{2\sqrt{2}}$

$\therefore$ Equilibrium concentration of B changes to $\dfrac{1}{2\sqrt{2}}$ times the original value.

54. 3 NO^- is having the bond order =2

but CN^- is having bond order =3

55. 3   Both are linear molecules.

56. 4

1)
cis

2)
trans

3)

4)

5)

6)
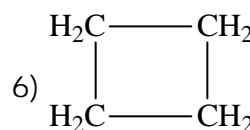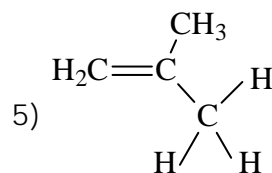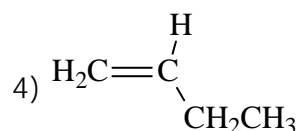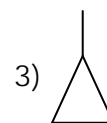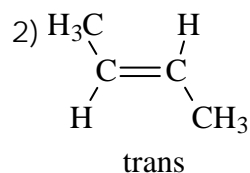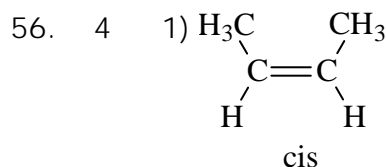
57. 4 BF_4^- - tetrahedral

$AlCl_3$ - Lewis acid

SnO - Can be oxidised to SnO_2

PbO_2 - Pb(iv) oxide, oxidising agent

58. 2   +M effect of NH_2>+M of -OH group disperse the charge of carbocation, hence increases the stability -CH_3 group shows +I effect, so it will disperse the charge less than -NH_2, -OH group. Whereas -NO_2 group shows -M/-I effect due to which the positive charge on the carbocation increases, hence stability decreases.

59. 3   Due to lone pair on N atom, it activated the ring. On the other hand, electronegativity of N is more than C so it deactivates the benzene ring via inductive effect.
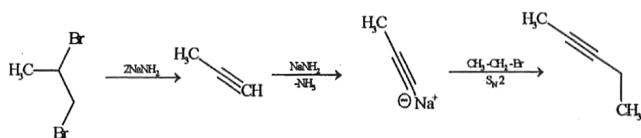
60. 4

61. 4 In $CH_2 = C= CH_2$ the end carbons **are sp^2** hybridised but central carbon is sp hybridised and each carbon is bonded to the other through double bonds
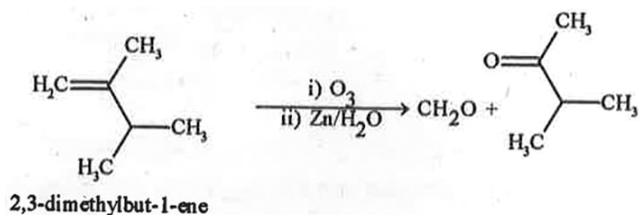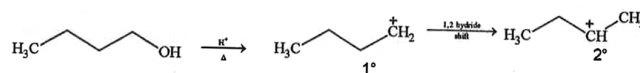
62. 1 HNO_3 accepts a proton from H_2SO_4.

$$H_2SO_4 + HNO_3 \rightleftharpoons HSO_4 +$$
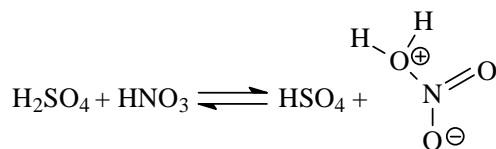
63. 3

Thus, X is three

64. 2

2,3-dimethylbut-1-ene

65. 3

66. 1 The given problem is related to the concept of stoichiometry of chemical equations. Thus, we have to convert the given volumes into their moles and then, identify the limiting reagent [possessing minimum number of moles and gets completely used up in the reaction]. The limiting reagent gives the moles of product formed in the reaction.
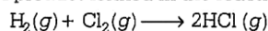
$$H_2(g) + Cl_2(g) \longrightarrow 2HCl\ (g)$$

Initial vol.   22.4 L   11.2 L   2 mol

∵   22.4 L volume at STP is occupied by
   Cl_2 = 1 mole

∴   11.2 L volume will be occupied by
   $Cl_2 = \dfrac{1 \times 11.2}{22.4}$ mol = 0.5 mol

22.4 L volume at STP is occupied by H_2 = 1 mol

Thus, $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$
           1 mol   1 mol   2 mol
Actually remaining 0.5 mol   0 mol   1 mol

67. 4 Weight of $^{200}X = 0.90 \times 200 = 180.00$ u

Weight of $^{199}X = 0.08 \times 199 = 15.92$ u

Weight of $^{202}X = 0.02 \times 202 = 4.04$ u

Total weight $= 199.96 \approx 200$ u

68. 1 According to Heisenberg's uncertainty principle

$$\Delta x \cdot \Delta p = \frac{h}{4\pi}$$

Given, $\Delta x = \Delta p$ (Δx = uncertainty in position)

$$(\Delta p)^2 = \frac{h}{4\pi}$$ ($\Delta p = m \times \Delta v$)

$$m^2 \Delta v^2 = \frac{h}{4\pi}$$ m = mass

$$\Delta v^2 = \frac{h}{m^2 4\pi} \Rightarrow \Delta v = \frac{1}{2m}\sqrt{\frac{h}{\pi}}$$

(Δv = uncertainty in velocity)

69. 2 The number of orbitals in a subshell $= (2l + 1)$ where, l = azimuthal quantum number

Since, each orbital contains maximum two electrons, the number of electrons in any subshell
   $= 2 \times$ number of orbitals $= 2 (2l + 1)$
   $= 4l + 2$

70. 2

| Structure		σ and π bonds
(a)		σ bond-4 π bond-1
(b)		σ bond-4 π bond-4
(c)	$N \equiv C - C \equiv N$	σ bond-3 π bond-4
(d)		σ bond-6 π bond-4

71. 2 In NH_4^+ bond angle is maximum (**nearer 109^{0}28$^|$**) due to its tetrahedral geometry.

72. 3   According to Avogadro's hypothesis,

Volume of a gas $(V) \propto$ number of moles (n)

Therefore, the ratio of the volumes of gases can be determined in terms of their moles.

∴ The ratio of volumes of $H_2 : O_2 :$ methane (CH_4) is given by

$$V_{H_2} : V_{O_2} : V_{CH_4} = n_{H_2} : n_{O_2} : n_{CH_4}$$

$$\Rightarrow \quad V_{H_2} : V_{O_2} : V_{CH_4} := \frac{m_{H_2}}{M_{H_2}} : \frac{m_{O_2}}{M_{O_2}} : \frac{m_{CH_4}}{M_{CH_4}}$$

Given, $\quad m_{H_2} = m_{O_2} = m_{CH_4} = m$

$$\left[\because n = \frac{\text{mass}}{\text{molar mass}} \right]$$

Thus, $V_{H_2} : V_{O_2} : V_{CH_4} = \dfrac{m}{2} : \dfrac{m}{32} : \dfrac{m}{16} = 16 : 1 : 2$

73. 2   Given, $N_2 + 3H_2 \rightleftharpoons 2NH_3, K_1$ ...(i)

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

$H_2 + \dfrac{1}{2}O_2 \longrightarrow H_2O, K_3$ ...(iii)

To calculate,

$$2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O,$$

$$K = ? \quad \text{...(iv)}$$

On reversing the equation (i) and multiplying the equation (iii) by 3, we get

$$2NH_3 \rightleftharpoons N_2 + 3H_2, \frac{1}{K_1} \quad \text{...(v)}$$

$$3H_2 + \frac{3}{2}O_2 \longrightarrow 3H_2O, K_3^3 \quad \text{...(vi)}$$

Now, add equation, (ii), (v) and (vi), we get the resultant equation. (iv).

$$2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O$$

∴ $\quad K = \dfrac{K_2 K_3^3}{K_1}$

74. 4   When we add heat to the equilibrium between solid and liquid, then the equilibrium shifts towards liquid and hence, the amount of solid decrease and amount of liquid increase. At equilibrium $\Delta T = 0$

75. 2   Given, pH of $Ba(OH)_2$ = 12

pOH = 14-pH

       = 14-12 = 2

$$Ba(OH)_2 \rightleftharpoons Ba^{2+} + 2OH^-$$
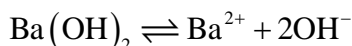
$$ksp = \left[Ba^{2+} \right]\left[OH^- \right]^2 = \left(\frac{10^{-2}}{2} \right)\left(10^{-2} \right)^2$$

$$= 5 \times 10^{-7}$$

76. 4   The species formed after adding a proton to the base is known as conjugate acid of the base and the species formed after losing a proton is known as conjugate base of acid. So,

$$\underset{\text{Base}}{NH_2^-} + H^+ \rightarrow \underset{\text{Conjugate acid}}{NH_3}$$
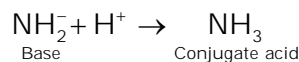
77. 1   % of carbon $= \dfrac{12}{44} \times \dfrac{w_1}{0.2} \times 100 = 69$

% of hydrogen $= \dfrac{2}{18} \times \dfrac{W_2}{0.2} \times 100 = 4.8$

78. 3   Given, $\quad \Delta H_{H-H} = 434$ kJ/mol

$$\Delta H_{Cl-Cl} = 242 \text{ kJ/mol}$$

$$\Delta H_{H-Cl} = 431 \text{ kJ/mol}$$

$$\frac{1}{2}H_2 + \frac{1}{2}Cl_2 \longrightarrow HCl, \Delta H_f = ?$$

$$\Delta H_f = \frac{1}{2} \times \Delta H_{H-H} + \frac{1}{2} \times \Delta H_{Cl-Cl} - \Delta H_{H-Cl}$$

$$= \frac{1}{2} \times 434 + \frac{1}{2} \times 242 - 431$$

$$= 217 + 121 - 431 = -93 \text{ kJ/mol}$$

79. 1   For spontaneous process, ΔS must be positive In reversible process

$$\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} = 0$$

Hence, system is present in equilibrium.

(i.e. it is not spontaneous process)

While in irreversible process

$$\Delta S_{\text{system}} + \Delta S_{\text{surrounding}} > 0$$

Hence, in the process ΔS is positive.

80. 3
- For ionic salts, hydrogen never behaves as cation, but behaves as anion (H^-).
- H_3O^+ exists freely in solution.
- Dihydrogen acts as a reducing agent.
- Hydrogen has three isotopes.
Protium $(^1_1 H)$

Deuterium $(^2_1 H)$

Tritium $(^3_1 H)$

Protium is the most common isotopes of hydrogen with an abundance of 99.98%.

81. 1   **Solubility of the sulphates**. The sulphates becomes less soluble as you go down the group i.e.

$$Mg > Ca > Sr > Ba$$
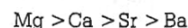
The magnitude of the lattice energy remains almost constant as the size of the sulphate ion is so big that small increase in the size of the cation from Be to Ba does not make any difference. However, the hydration energy decreases from Be^{2+} to Ba^{2+} appreciably as the size of the cation increases down the group. The significantly high solubility of $MgSO_4$ is due to high enthalpy of solvation of the smaller Mg^{2+} ions.

82. 2

H_2O_2 shows non-planar structure. It has a half opened book like structure in which the two O–H groups lie on the two pages of the book.
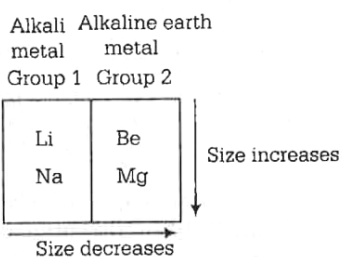

O—O single bond distance is 1.48 Å
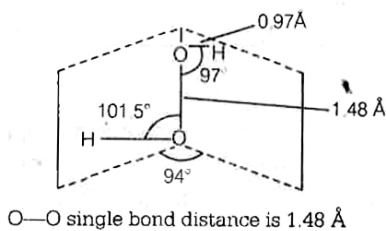
83. 3

Na⁻ has largest size because anion is always larger than neutral atom and cation is smaller than neutral atom. So the order is given as
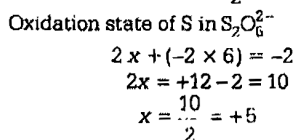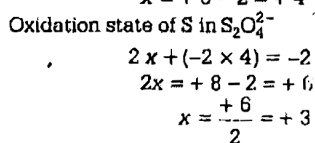
$$Na^- > Na > Na^+$$
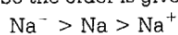
Anion > Parental atom > Cation

84. 3

Atomic size increases down the group and decreases in period from left to right. So, Be is smallest in size in these elements.


85. 2

Al < Ga < In < Tl

This is due to inert pair effect or tendency of ns^2 electrons do not participate in bond formation. This tendency decreases on moving down the group.

86. 3

Oxidation state of S in SO_3^{2-}

$$x + (-2 \times 3) = -2,$$
$$x = +6 - 2 = +4$$

Oxidation state of S in $S_2O_4^{2-}$

$$2x + (-2 \times 4) = -2$$
$$2x = +8 - 2 = +6$$
$$x = \frac{+6}{2} = +3$$

Oxidation state of S in $S_2O_6^{2-}$

$$2x + (-2 \times 6) = -2$$
$$2x = +12 - 2 = 10$$
$$x = \frac{10}{2} = +5$$

Hence, increasing order of oxidation states of S is
$$S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$$
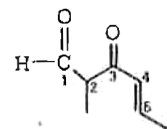
87. 1

—CHO group gets higher priority over >C = O and >C = C< group in numbering of principal carbon chain.

IUPAC name is 2 methyl- 3 oxohex- 4- enal

88. 1

$$KOH \longrightarrow K^+ + OH^-$$
$$RX + \underset{\text{Nucleophile}}{OH^-} \longrightarrow R - OH + X^-$$

OH⁻ is a stronger nucleophile than halogen. So it easily replace the weaker nucleophile.

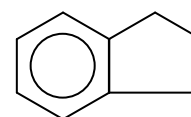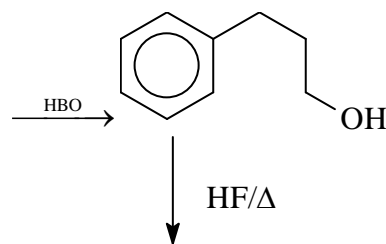Nucleophiles are either negative charge or lone pair of electrons bearing species, e.g. OH^-, $\ddot{N}H_3$, etc.
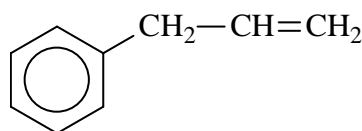
89. 4

$$KClO_3 \rightarrow KCl + \frac{3}{2}O_2$$
$$122.5g \qquad 48g$$

$$\therefore 6.125g \ KClO_3 = \frac{48}{122.5} \times 6.125g \ O_2 = 2.4gO_2$$

% purity $= \dfrac{2.232}{2.4} \times 100 = 93\%$

90. 2

BIOLOGY

91.	3	106.	2	121.	4	136.	1	151.	4	166.	4
92.	3	107.	2	122.	2	137.	3	152.	2	167.	1
93.	3	108.	2	123.	3	138.	2	153.	4	168.	2
94.	3	109.	1	124.	3	139.	4	154.	3	169.	3
95.	3	110.	1	125.	4	140.	2	155.	4	170.	4
96.	3	111.	1	126.	3	141.	4	156.	1	171.	4
97.	3	112.	4	127.	1	142.	3	157.	4	172.	2
98.	1	113.	4	128.	2	143.	2	158.	2	173.	4
99.	1	114.	1	129.	2	144.	3	159.	2	174.	1
100.	1	115.	3	130.	3	145.	4	160.	4	175.	2
101.	4	116.	4	131.	4	146.	1	161.	4	176.	4
102.	4	117.	4	132.	1	147.	3	162.	3	177.	2
103.	4	118.	3	133.	2	148.	2	163.	4	178.	2
104.	3	119.	1	134.	2	149.	2	164.	2	179.	1
105.	1	120.	2	135.	1	150.	1	165.	1	180.	3