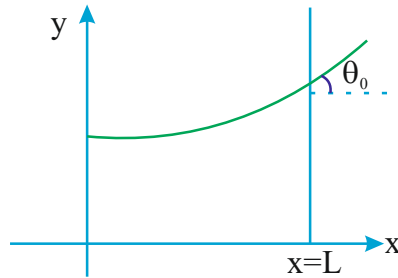


READ THE INSTRUCTIONS CAREFULLY**Important Instructions :**

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the test Booklet, take out the Answer Sheet and fill in the particulars on ORIGINAL Copy carefully with **Blue/Black ball point pen** only.
2. The test is of 3 hours duration and the Test Booklet contains **180** multiple-choice questions (four options with a single correct answer) from **Physics, Chemistry** and **Biology**. (Botany and Zoology).
3. Wherever the symbols/constants are not mentioned, they are to be considered as per their standard meaning/value.
4. Each Question carries **4 marks**, For each correct response, the candidate will get **4 marks**. For each incorrect response, **one mark** will be deducted from total scores. The Maximum marks are **720**.
5. Use **Blue/Black** Ball point Pen only for writing particulars on this page/markings responses on Answer sheet.
6. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
7. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
8. The CODE for this Booklet is **"45"**. Make sure to enter this code in the OMR answer sheet.
9. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
10. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
11. Each candidate must show on-demand his/her Admit Card to the Invigilator.
12. No candidate, without special permission of the Centre Superintendent or Invigilator, would leave his/her seat.
13. The candidate should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign (with time) the attendance sheet twice. Cases, where a candidate has not signed the attendance sheet second time, will be deemed not to have handed over the Answer Sheet and dealt with as an Unfair means case.
14. Use of Electronic/Manual Calculator is prohibited
15. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Room / Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.
16. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
17. The candidates will write the Correct Test Booklet Code as given in the Test Booklet / Answer Sheet in the Attendance Sheet.
18. If a candidate marks more than one answers for a question in the OMR Sheet, it will be treated as incorrect and negative marking will be applicable.

PHYSICS

1. Consider a water tank shown in the figure. It has one wall at $x = L$ and can be taken to be very wide in the z direction. When filled with a liquid of surface tension S and density ρ , the liquid surface makes angle θ_0 ($\theta_0 \ll 1$) with the x -axis at $x = L$. If $y(x)$ is the height of the surface then the equation for $y(x)$ is



(take $\theta(x) = \sin\theta(x) = \tan\theta(x) = \frac{dy}{dx}$, g is the acceleration due to gravity)

(1) $\frac{d^2y}{dx^2} = \frac{\rho g}{S} x$ (2) $\frac{d^2y}{dx^2} = \frac{\rho g}{S} y$ (3) $\frac{d^2y}{dx^2} = \sqrt{\frac{\rho g}{S}}$ (4) $\frac{dy}{dx} = \sqrt{\frac{\rho g}{S}} x$

Ans: (2)

Solutions: $\Delta P = \rho g y$

...(1)

$$\Delta P = S \frac{d^2y}{dx^2}$$

...(2)

From Equation (1) and (2)

$$\frac{d^2y}{dx^2} = \frac{\rho g}{S} y.$$

2. A microscope has an objective of focal length 2 cm, eyepiece of focal length 4 cm and the tube length of 40 cm. If the distance of distinct vision of eye is 25 cm, the magnification in the microscope is

- (1) 100 (2) 125 (3) 150 (4) 250

Ans : (2)

Solutions : The overall magnification $\frac{L}{f_o} \times \frac{D}{f_e}$.

3. An electron (mass 9×10^{-31} kg and charge 1.6×10^{-19} C) moving with speed $c/100$ (c = speed of light) is injected into a magnetic field \vec{B} of magnitude 9×10^{-4} T perpendicular to its direction of motion. We wish to apply an uniform electric field \vec{E} together with the magnetic field so that the electron does not deflect from its path. Then (speed of light $c = 3 \times 10^8$ ms $^{-1}$)

- (1) \vec{E} is perpendicular to \vec{B} and its magnitude is 27×10^4 V m $^{-1}$
 (2) \vec{E} is perpendicular to \vec{B} and its magnitude is 27×10^2 V m $^{-1}$
 (3) \vec{E} is parallel to \vec{B} and its magnitude is 27×10^2 V m $^{-1}$
 (4) \vec{E} is parallel to \vec{B} and its magnitude is 27×10^4 V m $^{-1}$

Ans : (2)

Solutions : In the combined field if there is no deflection then $\vec{E} = \vec{B} \times \vec{V}$.

4. There are two inclined surfaces of equal length (L) and same angle of inclination 45° with the horizontal. One of them is rough and the other is perfectly smooth. A given body takes 2 times as much time to slide down on rough surface than on the smooth surface. The coefficient of kinetic friction (μ_k) between the object and the rough surface is close to

- (1) 0.25 (2) 0.40 (3) 0.5 (4) 0.75

Ans : (4)

Solutions : $a \times t^2 = \text{constant}$, without friction a_1 is $g \sin \theta$. And with friction a_2 is $g (\sin \theta - \mu \cos \theta)$.

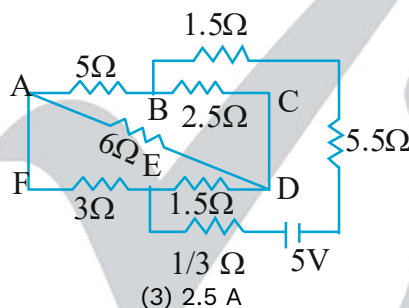
5. The kinetic energies of two similar cars A and B are 100 J and 225 J respectively. On applying breaks, car A stops after 1000 m and car B stops after 1500 m. If F_A and F_B are the forces applied by the breaks on cars A and B respectively, then the ratio F_A/F_B is

- (1) $\frac{3}{2}$ (2) $\frac{2}{3}$ (3) $\frac{1}{3}$ (4) $\frac{1}{2}$

Ans: (2)

Solutions: $v^2 = 2as$, $\frac{v^2}{2s} = a$.

6. The current passing through the battery in the given circuit, is



- (1) 2.0 A (2) 0.5 A (3) 2.5 A (4) 1.5 A

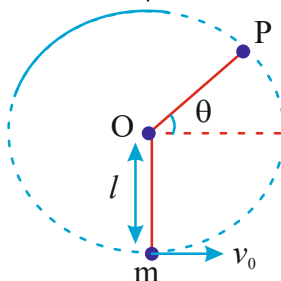
Ans: (2)

Solutions: Balance wheat stone bridge is formed so, 6Ω resistance between A and D is neglected.

$$\text{So, } R = \frac{8}{3} + \frac{1}{3} + 7 = 10\Omega$$

$$I = \frac{V}{R} = 0.5 \text{ A.}$$

7. A bob of heavy mass m is suspended by a light string of length l . The bob is given a horizontal velocity v_0 as shown in figure. If the string gets slack at some point P making an angle θ from the horizontal, the ratio of the speed v of the bob at point P to its initial speed v_0 is

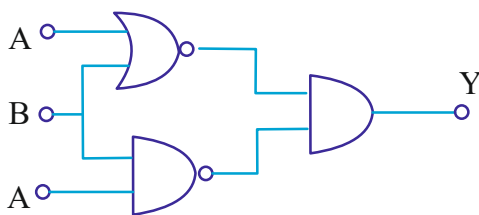


- (1) $(\sin \theta)^{1/2}$ (2) $\left(\frac{1}{2+3\sin \theta} \right)^{1/2}$ (3) $\left(\frac{\cos \theta}{2+3\sin \theta} \right)^{1/2}$ (4) $\left(\frac{\sin \theta}{2+3\sin \theta} \right)^{1/2}$

Ans: (4)

Solutions: At the point of slaking $V^2 = rg \sin \theta = u_2 - 2gr (1 + \sin \theta)$.

8. The output (Y) of the given logic implementation is similar to the output of an/a _____ gate.



- (1) AND (2) NAND (3) OR (4) NOR

Ans: (4)

Solutions: $Y = \overline{A + B}$.

9. The electric field in a plane electromagnetic wave is given by

$$E_z = 60 \cos(5x + 1.5 \times 10^9 t) \text{ V/m.}$$

Then expression for the corresponding magnetic field is (here subscripts denote the direction of the field)

- (1) $B_y = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t) \text{ T}$ (2) $B_x = 2 \times 10^{-7} \cos(5x + 1.5 \times 10^9 t) \text{ T}$
 (3) $B_z = 60 \cos(5x + 1.5 \times 10^9 t) \text{ T}$ (4) $B_y = 60 \sin(5x + 1.5 \times 10^9 t) \text{ T}$

Ans: (1)

Solutions: $\frac{E}{B} = C$, where C is a speed of light and E, B and direction of propagation of wave are mutually perpendicular.

10. A ball of mass 0.5 kg is dropped from a height of 40 m. The ball hits the ground and rises to a height of 10 m. The impulse imparted to the ball during its collision with the ground is (Take $g = 9.8 \text{ m/s}^2$)

- (1) 21 NS (2) 7 NS (3) 0 (4) 84 NS

Ans: (1)

Solutions: Impulse = change in momentum, momentum before collision = $m \times \sqrt{2g \times 40}$. And momentum after collision is $m \times \sqrt{2g \times 10}$. And the change in momentum is sum of both.

11. AB is a part of an electrical circuit (see figure). The potential difference " $V_A - V_B$ ", at the instant when current $I = 2 \text{ A}$ and is increasing at a rate of 1 amp / second is



- (1) 5 volt (2) 6 volt (3) 9 volt (4) 10 volt

Ans : (4)

Solutions: The voltage across 2Ω is 4 volt and polarity $\downarrow \uparrow$. And the voltage across inductor is $L \frac{di}{dt}$. Which is 1 and polarity $\downarrow \uparrow$.

12. A 2 amp current is flowing through two different small circular copper coils having radii ratio 1 : 2. The ratio of their respective magnetic moments will be

- (1) 1: 4 (2) 1 : 2 (3) 2 : 1 (4) 4 : 1

Ans: (1)

Solutions: Magnetic moment = $I \times A$, where I is current in the coil and A is area of the circular coil.

13. In a certain camera, a combination of four similar thin convex lenses are arranged axially in contact. Then the power of the combination and the total magnification in comparison to the power (p) and magnification (m) for each lens will be, respectively

(1) 4p and 4m (2) p^4 and 4m (3) 4p and m^4 (4) p^4 and m^4

Ans: (3)

Solutions: For combination of lens $p_{\text{effective}} = \sum p$. And $m_{\text{effective}} = m_1 \times m_2 \times m_3 \times m_4$.

14. An oxygen cylinder of volume 30 litre has 18.20 moles of oxygen. After some oxygen is withdrawn from the cylinder, its gauge pressure drops to 11 atmospheric pressure at temperature 27°C . The mass of the oxygen withdrawn from the cylinder is nearly equal to

[Given, $R = \frac{100}{12} \text{ J mol}^{-1} \text{ K}^{-1}$, and molecular mass of $\text{O}_2 = 32$, 1 atm pressure = $1.01 \times 10^5 \text{ N/m}^2$]

(1) 0.125 kg (2) 0.144 kg (3) 0.116 kg (4) 0.156 kg

Ans: (3)

Solutions: $n_2 = \frac{P_2 V}{RT} \approx 14.544 \text{ mol}$

$$\Delta n = 18.2 - 14.544 = 3.656 \text{ moles}$$

$$m = \Delta n \times M = 3.656 \times 0.032 = 0.116 \text{ kg.}$$

15. In some appropriate units, time (t) and position (x) relation of a moving particle is given by $t = x^2 + x$. The acceleration of the particle is

(1) $-\frac{2}{(x+2)^3}$ (2) $-\frac{2}{(2x+1)^3}$ (3) $+\frac{2}{(x+1)^3}$ (4) $+\frac{2}{2x+1}$

Ans: (2)

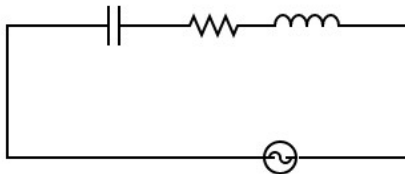
Solutions: $\frac{dt}{dx} = \frac{1}{v} = 2x + 1$ and $\frac{-1}{v^2} \times \frac{dv}{dt} = 2v$, $a = -2v^3$.

16. To an ac power supply of 220 V at 50 Hz, a resistor of 20Ω , a capacitor of reactance 25Ω and an inductor of reactance 45Ω are connected in series. The corresponding current in the circuit and the phase angle between the current and the voltage is, respectively

(1) 7.8 A and 30° (2) 7.8 A and 45° (3) 15.6 A and 30° (4) 15.6 A and 45°

Ans: (2)

Solutions: $R = 20 \Omega$, $X_L = 45 \Omega$, $X_C = 20 \Omega$



$$I = \frac{220}{\sqrt{R^2 + (X_L - X_C)^2}}$$

$$I = \frac{220}{\sqrt{20^2 + 20^2}}$$

$$I = \frac{220}{20\sqrt{2}} = 7.8 \text{ A}$$

$$\tan \phi = \frac{X_L - X_C}{R} = \frac{20}{20} = 1 \Rightarrow \phi = 45^\circ$$

17. The Sun rotates around its centre once in 27 days. What will be the period of revolution if the Sun were to expand to twice its present radius without any external influence? Assume the Sun to be a sphere of uniform density.

(1) 100 days (2) 105 days (3) 115 days (4) 108 days

Ans: (4)

Solutions: By using angular momentum conservation.

$$I_1 \omega_1 = I_2 \omega_2$$

$$\frac{2}{5} M r_1^2 \times \frac{2\pi}{T_1} = \frac{2}{5} M r_2^2 \times \frac{2\pi}{T_2}$$

$$\frac{r_1^2}{T_1} = \frac{r_2^2}{T_2}$$

$$\frac{r^2}{27} = \frac{4r^2}{T_2} \Rightarrow \boxed{T_2 = 108 \text{ days}}$$

18. A model for quantized motion of an electron in a uniform magnetic field B states that the flux passing through the orbit of the electron is $n(h/e)$ where n is an integer, h is Planck's constant and e is the magnitude of electron's charge. According to the model, the magnetic moment of an electron in its lowest energy state will be (m is the mass of the electron)

(1) $\frac{he}{\pi m}$ (2) $\frac{he}{2\pi m}$ (3) $\frac{heB}{\pi m}$ (4) $\frac{heB}{2\pi m}$

Ans : (2)

Solutions: As given,

$$\text{Flux } \phi = \frac{nh}{e}$$

$$B \cdot \pi r^2 = \frac{nh}{e} \quad \dots (i)$$

Now magnetic moment of rotating electron is

$$M = \frac{evr}{2}$$

For electron undergoing circular motion in magnetic field

$$r = \frac{mv}{eB} \Rightarrow v = \frac{eBr}{m}$$

$$M = \frac{ev}{2} \times \frac{eBr}{m}$$

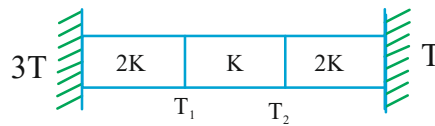
$$Br^2 = \frac{nh}{e\pi}$$

$$M = \frac{e^2}{2m} \times \frac{nh}{e\pi}$$

For $n=1$

$$\boxed{M = \frac{he}{2\pi m}}$$

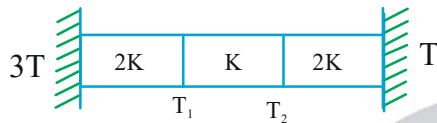
19. Three identical heat conducting rods are connected in series as shown in the figure. The rods on the sides have thermal conductivity $2K$ while that in the middle has thermal conductivity K . The left end of the combination is maintained at temperature $3T$ and the right end at T . The rods are thermally insulated from outside. In steady state, temperature at the left junction is T_1 and that at the right junction is T_2 . The ratio T_1/T_2 is



- (1) $\frac{3}{2}$ (2) $\frac{4}{3}$ (3) $\frac{5}{3}$ (4) $\frac{5}{4}$

Ans: (3)

Solutions:



Here R is thermal resistance of side conductor.

Total rate of heat flow

$$\dot{Q} = \frac{3T - T}{4R} = \frac{T}{2R}$$

Now For T_1

$$\frac{3T - T_1}{R} = \frac{T}{2R} \Rightarrow T_1 = 3T - \frac{T}{2} = \frac{5T}{2}$$

Now For T_2

$$\frac{T_2 - T}{R} = \frac{T}{2R} \Rightarrow T_2 = T + \frac{T}{2} = \frac{3T}{2}$$

$$\frac{T_1}{T_2} = \frac{5T/2}{3T/2} = \boxed{\frac{5}{3}}$$

20. The plates of a parallel plate capacitor are separated by d . Two slabs of different dielectric constant K_1 and K_2 with thickness $\frac{3}{8}d$ and $\frac{d}{2}$, respectively are inserted in the capacitor. Due to this, the capacitance becomes two times larger than when there is nothing between the plates.

If $K_1 = 1.25 K_2$, the value of K_1 is

- (1) 2.66 (2) 2.33 (3) 1.60 (4) 1.33

Ans: (1)

Solutions: $2 \times \frac{\epsilon_0 A}{d} = \frac{\epsilon_0 A}{\frac{d}{8} + \frac{3d}{8K_1} + \frac{d}{2K_2}}$

$$\frac{1}{4} + \frac{3}{4K_1} + \frac{1}{K_2} = 1$$

$$\frac{3}{4K_1} + \frac{5}{4K_1} = \frac{3}{4}$$

$$\boxed{K_1 = \frac{8}{3}}$$

21. Two cities X and Y are connected by a regular bus service with a bus leaving in either direction every T min. A girl is driving scooter with a speed of 60 km/h in the direction X to Y notices that a bus goes past her every 30 minutes in the direction of her motion, and every 10 minutes in the opposite direction. Choose the correct option for the period T of the bus service and the speed (assumed constant) of the buses.
- (1) 9 min, 40 km/h (2) 25 min, 100 km/h
(3) 10 min, 90 km/h (4) 15 min, 120 km/h

Ans: (4)

Solutions: Bus crosses every 30 minute in the direction of motion

Relative velocity = $V - 60$

Distance between two

$$d = (V - 60) \times \frac{30}{60} \quad \dots(1)$$

From opposite direction, relative velocity = $V + 60$

$$d = (V + 60) \times \frac{10}{60} \quad \dots(2)$$

By using (1) and (2)

$$V = 120 \text{ km/h}$$

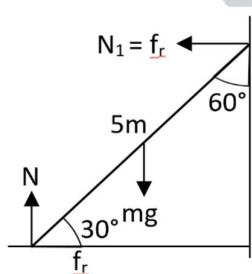
$$d = V \times T = (V + 60) \times \frac{10}{60}$$

$$T = 15 \text{ min.}$$

22. A uniform rod of mass 20 kg and length 5 m leans against a smooth vertical wall making an angle of 60° with it. The other end rests on a rough horizontal floor. The friction force that the floor exerts on the rod is (take $g = 10 \text{ m/s}^2$)
- (1) 100 N (2) $100\sqrt{3}$ N (3) 200 N (4) $200\sqrt{3}$ N

Ans: (2)

Solutions:



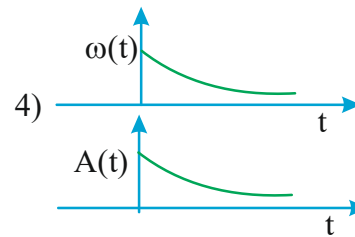
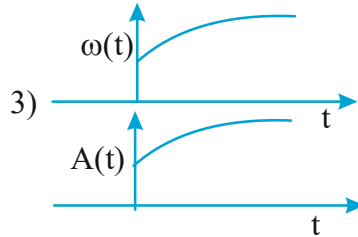
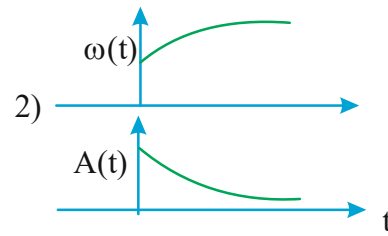
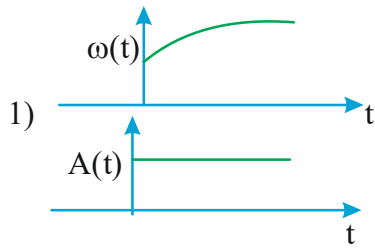
Balancing torque about point of contact with ground.

$$mg \times \frac{5}{2} \times \frac{\sqrt{3}}{2} = f_r \times \frac{5}{2}$$

$$200 \times \frac{\sqrt{3}}{2} = f_r$$

$$\boxed{f_r = 100\sqrt{3}}$$

23. In an oscillating spring mass system, a spring is connected to a box filled with sand. As the box oscillates, sand leaks slowly out of the box vertically so that the average frequency $\omega(t)$ and average amplitude $A(t)$ of the system change with time t. Which one of the following options schematically depicts these changes correctly?



Ans: (2)

Solutions: $\omega = \sqrt{\frac{k}{m}}$

$$\omega(t) = \sqrt{\frac{k}{m(t)}}$$

As $m(t)$ decreasing so $\omega(t)$ will be increasing and at the end will be constant

As mass leaving the system without any relative velocity. So energy decreasing. As spring constant is constant so amplitude should decrease.

24. A balloon is made of a material of surface tension S and its inflation outlet (from where gas is filled in it) has small area A . It is filled with a gas of density ρ and takes a spherical shape of radius R . When the gas is allowed to flow freely out of it, its radius r changes from R to 0 (zero) in time T . If the speed $v(r)$ of gas coming out of the balloon depends on r and r^a and $T \propto S^\alpha A^\beta \rho^\gamma R^\delta$ then

(1) $a = \frac{1}{2}, \alpha = \frac{1}{2}, \beta = -1, \gamma = +1, \delta = \frac{3}{2}$

(2) $a = -\frac{1}{2}, \alpha = -\frac{1}{2}, \beta = -1, \gamma = -\frac{1}{2}, \delta = \frac{5}{2}$

(3) $a = -\frac{1}{2}, \alpha = -\frac{1}{2}, \beta = -1, \gamma = \frac{1}{2}, \delta = \frac{7}{2}$

(4) $a = \frac{1}{2}, \alpha = \frac{1}{2}, \beta = -\frac{1}{2}, \gamma = \frac{1}{2}, \delta = \frac{7}{2}$

Ans: (3)

Solutions: By writing dimension on both side

$$[T] \propto [MT^{-2}]^\alpha [L^2]^\beta [ML^{-3}]^\gamma [L]^\delta$$

On comparing dimension of T

$$1 = -2\alpha$$

$$\alpha = -\frac{1}{2}$$

On comparing dimension of M

$$0 = \alpha + \gamma$$

$$\gamma = \frac{1}{2}$$

Only (3) option will be correct.

25. Consider the diameter of a spherical object being measured with the help of a Vernier calipers. Suppose its 10 Vernier Scale Divisions (V.S.D.) are equal to its 9 Main Scale Divisions (M.S.D.). The

least division in the M.S. is 0.1 cm and the zero of V.S. is at $x = 0.1$ cm when the jaws of Vernier calipers are closed.

If the main scale reading for the diameter is $M = 5$ cm and the number of coinciding vernier division is 8, the measured diameter after zero error correction, is

- (1) 5.18 cm (2) 5.08 cm (3) 4.98 cm (4) 5.00 cm

Ans : (3)

Solutions: 1 MSD = 0.1 cm

LC = 0.01 cm

Zero error = -0.1 cm

Reading = MSR + LC \times (VSR)

MSR = 5 cm

VSR = 8

measurement = $5 + 0.01 \times 8 = 5.08$

Correct reading = measurement – Zero error
 $= 5.08 - 0.1 = 4.98$ cm

26. A parallel plate capacitor made of circular plates is being charged such that the surface charge density on its plates is increasing at a constant rate with time. The magnetic field arising due to displacement current is :

- (1) zero at all places
(2) constant between the plates and zero outside the plates
(3) non-zero everywhere with maximum at the imaginary cylindrical surface connecting peripheries of the plates
(4) zero between the plates and non-zero outside

Ans: (3)

Solutions: Enclosed displacement current will be maximum at surface of cylinder

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_d$$

Magnetic field will be non-zero everywhere and maximum at surface.

27. An unpolarized light beam travelling in air is incident on a medium of refractive index 1.73 at Brewster's angle. Then -

- (1) reflected light is completely polarized and the angle of reflection is close to 60°
(2) reflected light is partially polarized and the angle of reflection is close to 30°
(3) both reflected and transmitted light are perfectly polarized with angles of reflection and refraction close to 60° and 30° , respectively
(4) transmitted light is completely polarized with angle of refraction close to 30°

Ans: (1)

Solutions: By Brewster's law

$$\tan \theta = 1.73 = \sqrt{3}$$

$$\theta = \tan^{-1}(\sqrt{3})$$

$$\theta \approx 60^\circ$$

Reflected light is completely polarized.

28. Two identical charged conducting spheres A and B have their centres separated by a certain distance. Charge on each sphere is q and the force of repulsion between them is F . A third identical uncharged conducting sphere is brought in contact with sphere A first and then with B and finally removed from both. New force of repulsion between spheres A and B (Radii of A and B are negligible compared to the distance of separation so that for calculating force between them they can be considered as point charges) is best given as :

$$(1) \frac{3F}{5}$$

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

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

$$(4) \frac{3F}{8}$$

Ans: (4)

Solutions: $F = \frac{kq^2}{d^2} \dots (1)$

Finally charge on ball A is $\frac{q}{2}$ and charge on ball B $\frac{3q}{4}$.

$$F' = \frac{kq^2}{d^2} \times \frac{3}{8}$$

$$\boxed{F' = \frac{3}{8}F}$$

29. A container has two chambers of volumes $V_1 = 2$ litres and $V_2 = 3$ litres separated by a partition made of a thermal insulator. The chambers contains $n_1 = 5$ and $n_2 = 4$ moles of ideal gas at pressures $p_1 = 1$ atm and $p_2 = 2$ atm, respectively. When the partition is removed, the mixture attains an equilibrium pressure of :

(1) 1.3 atm

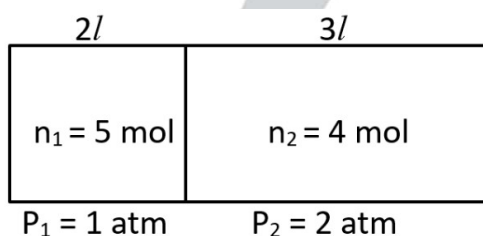
(2) 1.6 atm

(3) 1.4 atm

(4) 1.8 atm

Ans : (2)

Solutions:



By conservation of Internal energy

$$\frac{f}{2} \times 1 \times 2 + \frac{f}{2} \times 2 \times 3 = \frac{f}{2} P \times 5$$

$$P = \frac{8}{5} = 1.6 \text{ atm}$$

30. A particle of mass m is moving around the origin with a constant force F pulling it towards the origin. If Bohr model is used to describe its motion, the radius r of the n^{th} orbit and the particle's speed v in the orbit depend on n as

(1) $r \propto n^{1/3}$; $v \propto n^{1/3}$ (2) $r \propto n^{1/3}$; $v \propto n^{2/3}$ (3) $r \propto n^{2/3}$; $v \propto n^{1/3}$ (4) $r \propto n^{4/3}$; $v \propto n^{-1/3}$

Ans: (3)

Solutions: $F = \frac{mv^2}{r}$

$$mvr = \frac{nh}{2\pi}$$

$$r = \frac{nh}{2\pi mv}$$

$$F = \frac{mv^2 \times 2\pi mv}{nh}$$

$$n \propto v^3$$

$$v \propto n^{\frac{1}{3}}$$

$$r \propto v^2$$

$$r \propto n^{\frac{2}{3}}$$

31. The radius of Martian orbit around the Sun is about 4 times the radius of the orbit of Mercury. The Martian year is 687 Earth days. Then which of the following is the length of 1 year on Mercury ?
 (1) 88 earth days (2) 225 earth days (3) 172 earth days (4) 124 earth days

Ans: (1)

Solutions: $\frac{(687)^2}{T^2} = \frac{(4r)^3}{r^3}$

$$\left(\frac{687}{T}\right)^2 = 64$$

$$T = \frac{687}{8} \approx 88.$$

32. A body weighs 48 N on the surface of the earth. The gravitational force experienced by the body due to the earth at a height equal to one-third the radius of the earth from its surface is :
 (1) 16 N (2) 27 N (3) 32 N (4) 36 N

Ans : (2)

Solutions: $g_h = g \left(\frac{R}{R + R/3} \right)^2$

$$g_h = g \frac{9}{16}$$

$$W_2 = 48 \times \frac{9}{16} = 27 \text{ N.}$$

33. A wire of resistance R is cut into 8 equal pieces. From these pieces two equivalent resistances are made by adding four of these together in parallel. Then these two sets are added in series. The net effective resistance of the combination is

(1) $\frac{R}{64}$ (2) $\frac{R}{32}$ (3) $\frac{R}{16}$ (4) $\frac{R}{8}$

Ans: (3)

Solutions: $R_{eq} = \frac{R}{32} + \frac{R}{32} = \frac{R}{16}.$

34. De-Broglie wavelength of an electron orbiting in the $n = 2$ state of hydrogen atom is close to (Given Bohr radius = 0.052 nm)
 (1) 0.067 nm (2) 0.67 nm (3) 1.67 nm (4) 2.67 nm

Ans : (2)

Solutions: $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}} = 0.67 \text{ nm}.$

35. An electric dipole with dipole moment $5 \times 10^{-6} \text{ Cm}$ is aligned with the direction of a uniform electric field of magnitude $4 \times 10^5 \text{ N/C}$. The dipole is then rotated through an angle of 60° with respect to the electric field. The change in the potential energy of the dipole is :

(1) 0.8 J (2) 1.0 J (3) 1.2 J (4) 1.5 J

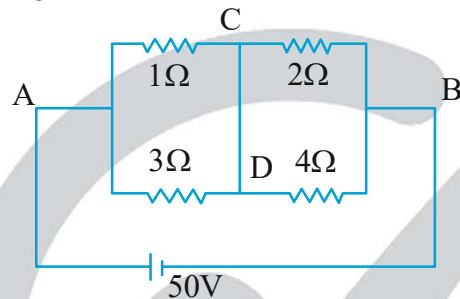
Ans : (2)

Solutions : $U_i = -PE \cos 0 = -2 \text{ J}$

$U_f = -PE \cos 60 = -1 \text{ J}$

$\Delta U = 1.0 \text{ Joule}.$

36. A constant voltage of 50 V is maintained between the points A and B of the circuit shown in the figure. The current through the branch CD of the circuit is :



(1) 1.5 A (2) 2.0 A (3) 2.5 A (4) 3.0 A

Ans: (2)

Solutions: By KVL, $I = 2 \text{ amp}.$

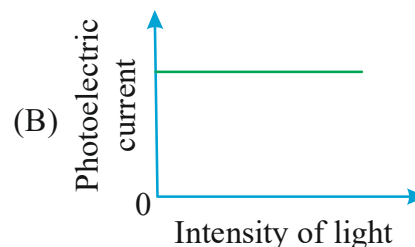
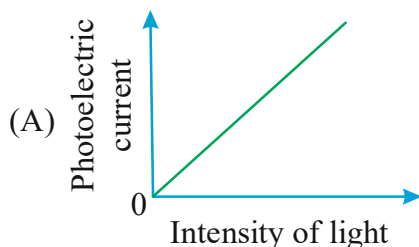
37. A photon and an electron (mass m) have the same energy E . The ratio $(\lambda_{\text{photon}} / \lambda_{\text{electron}})$ of their de Broglie wavelengths is : (c is the speed of light)

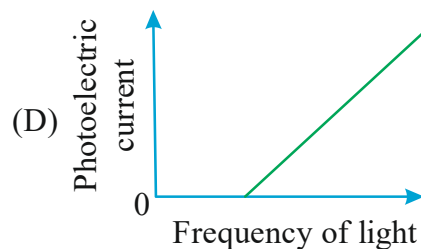
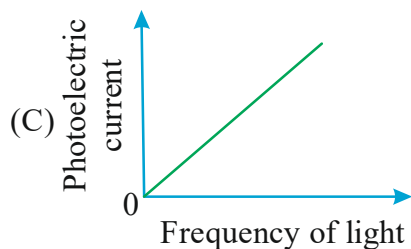
(1) $\sqrt{E/2m}$ (2) $c\sqrt{2mE}$ (3) $c\sqrt{\frac{2m}{E}}$ (4) $\frac{1}{c}\sqrt{\frac{E}{2m}}$

Ans : (3)

Solutions: $\frac{\lambda_{\text{photon}}}{\lambda_{\text{electron}}} = \frac{\frac{hc}{E}}{\frac{h}{\sqrt{2mE}}} = c\sqrt{\frac{2m}{E}}.$

38. Which of the following options represent the variation of photoelectric current with property of light shown on the x-axis ?





(1) A only

(2) A and C

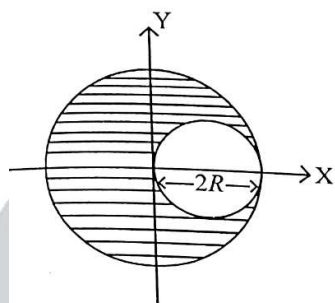
(3) A and D

(4) B and D

Ans: (1)

Solutions: Photoelectric current \propto intensity of incident radiation.

39. A sphere of radius R is cut from a larger solid sphere of radius $2R$ as shown in the figure. The ratio of the moment of inertia of the smaller sphere to that of the rest part of the sphere about the Y -axis is :



(1) $\frac{7}{8}$

(2) $\frac{7}{40}$

(3) $\frac{7}{57}$

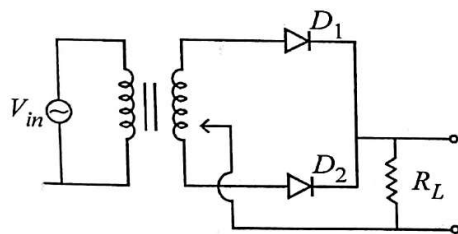
(4) $\frac{7}{64}$

Ans : (3)

Solutions : $I_{\text{small sphere}} = \left(\frac{2m}{5} R^2 + \frac{m}{8} R^2 \right) = \frac{7}{40} mR^2$

$$I_{\text{remaining portion}} = \frac{2}{5} m(2R)^2 - \frac{7}{40} mR^2 = \frac{57}{40} mR^2$$

40. A full wave rectifier circuit with diodes (D_1) and (D_2) is shown in the figure. If input supply voltage $V_{in} = 220 \sin(100\pi t)$ volt, then at $t = 15$ m sec



- (1) D_1 is forward biased, D_2 is reverse biased
 (2) D_1 is reverse biased, D_2 is forward biased
 (3) D_1 and D_2 both are forward biased
 (4) D_1 and D_2 both are reverse biased

Ans : (2)

Solutions : The time period is 20 m sec hence in 15 m sec D_1 is in reverse bias and D_2 is forward bias.

41. Two gases A and B are filled at the same pressure in separate cylinders with movable pistons of radius r_A and r_B , respectively. On supplying an equal amount of heat to both the systems reversibly

under constant pressure, the pistons of gas A and B are displaced by 16 cm and 9 cm, respectively.

If the change in their internal energy is the same, then the ratio $\frac{r_A}{r_B}$ is equal to

- (1) $\frac{4}{3}$ (2) $\frac{3}{4}$ (3) $\frac{2}{\sqrt{3}}$ (4) $\frac{\sqrt{3}}{2}$

Ans: (2)

Solutions: $Q = W + \Delta U$

$$\Rightarrow W = \text{const}$$

$$\Rightarrow PA\ell = \text{const}$$

$$\Rightarrow \frac{r_A}{r_B} = \frac{3}{4}.$$

42. A physical quantity P is related to four observations a, b, c and d as follows :

$$P = a^3 b^2 / c \sqrt{d}$$

The percentage errors of measurement in a, b, c and d are 1%, 3%, 2% and 4% respectively. The percentage error in the quantity P is

- (1) 10% (2) 2% (3) 13% (4) 15%

Ans: (3)

Solutions : $\frac{dP}{P} = 3 \frac{da}{a} + 2 \frac{db}{b} + \frac{dc}{c} + \frac{1}{2} \frac{dd}{d} = 13\%.$

43. The intensity of transmitted light when a polaroid sheet, placed between two crossed polaroids at 22.5° from the polarization axis of one of the polaroid, is (I_0 is the intensity of polarized light after passing through the first polaroid) :

- (1) $\frac{I_0}{2}$ (2) $\frac{I_0}{4}$ (3) $\frac{I_0}{8}$ (4) $\frac{I_0}{16}$

Ans: (3)

Solutions: $\frac{I_0}{8}.$

44. Two identical point masses P and Q, suspended from two separate massless springs of spring constants k_1 and k_2 , respectively, oscillate vertically. If their maximum speeds are the same, the ratio (A_Q/A_P) of the amplitude A_Q of mass Q to the amplitude A_P of mass P is :

- (1) $\frac{k_2}{k_1}$ (2) $\frac{k_1}{k_2}$ (3) $\sqrt{\frac{k_2}{k_1}}$ (4) $\sqrt{\frac{k_1}{k_2}}$

Ans: (4)

Solutions: $\sqrt{\frac{k_1}{m}} A_P = \sqrt{\frac{k_2}{m}} A_Q$

$$\frac{A_Q}{A_P} = \sqrt{\frac{k_1}{k_2}}.$$

45. A pipe open at both ends has a fundamental frequency f in air. The pipe is now dipped vertically in a water drum to half of its length. The fundamental frequency of the air column is now equal to

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

(2) f

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

(4) $2f$

Ans: (2)

Solutions: $f = \frac{v}{2\ell}$

$$f' = \frac{v}{4\left(\frac{\ell}{2}\right)} = \frac{v}{2\ell} = f.$$

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46. The ratio of the wavelengths of the light absorbed by a Hydrogen atom when it undergoes $n = 2 \rightarrow n = 3$ and $n = 4 \rightarrow n = 6$ transitions, respectively, is

(1) $\frac{1}{36}$

(2) $\frac{1}{16}$

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

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

Ans : (4)

Solutions : $\frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$

$$\frac{1}{\lambda_1} = R_H \left[\frac{1}{4} - \frac{1}{9} \right] = \frac{5R_H}{36}$$

$$\frac{1}{\lambda_2} = R_H \left[\frac{1}{16} - \frac{1}{36} \right] = \frac{20R_H}{16 \times 36}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{1}{4}$$

47. Which of the following statements are true?

A. Unlike Ga that has a very high melting point, Cs has a very low melting point.

B. On Pauling scale, the electronegativity values of N and Cl are not the same.

C. Ar, K^+, Cl^-, Ca^{2+} , and S^{2-} are all isoelectronic species

D. The correct order of the first ionization enthalpies of Na, Mg, Al, and Si is $Si > Al > Mg > Na$.

E. The atomic radius of Cs is greater than that of Li and Rb.

Choose the correct answer from the options given below:

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

Ans: (2)

Solutions: $Ar, K^+, Cl^-, Ca^{2+}, S^{2-}$ all have $18e^-$ s and hence they all are isoelectronic.

Atomic radii $Cs > Rb > Li$

So only C and E are correct

48. Match List I with List II

	List I (Ion)		List II (Group Number in Cation Analysis)
A.	Co^{2+}	I.	Group I

B.	Mg^{2+}	II.	Group III
C.	Pb^{2+}	III.	Group IV
D.	Al^{3+}	IV.	Group VI

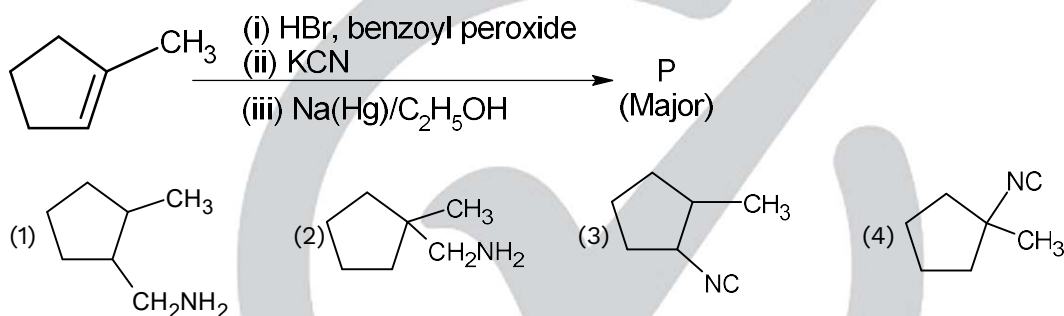
Choose the correct answer from the options given below:

- (1) A-III, B-IV, C-II, D-I (2) A-III, B-IV, C-I, D-II
 (3) A-III, B-II, C-IV, D-I (4) A-III, B-II, C-I, D-IV

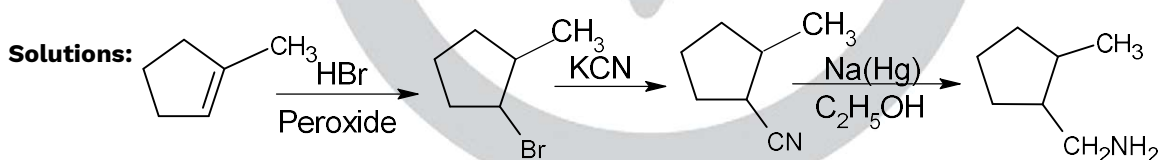
Ans: (2)

Solutions: Co^{2+} Group IV
 Mg^{2+} Group VI
 Pb^{2+} Group I
 Al^{3+} Group III

49. Predict the major product 'P' in the following sequence of reactions:-



Ans: (1)



50. Energy and radius of first Bohr orbit of He^+ and Li^{2+} are

[Given $R_H = 2.18 \times 10^{-18} J$, $a_0 = 52.9 pm$]

- (1) $E_n(Li^{2+}) = -19.62 \times 10^{-18} J$;
 $r_n(Li^{2+}) = 17.6 pm$
 $E_n(He^+) = -8.72 \times 10^{-18} J$;
 $r_n(He^+) = 26.4 pm$
- (2) $E_n(Li^{2+}) = -8.72 \times 10^{-18} J$;
 $r_n(Li^{2+}) = 26.4 pm$
 $E_n(He^+) = -19.62 \times 10^{-18} J$;
 $r_n(He^+) = 17.6 pm$
- (3) $E_n(Li^{2+}) = -19.62 \times 10^{-16} J$;
 $r_n(Li^{2+}) = 17.6 pm$
 $E_n(He^+) = -8.72 \times 10^{-16} J$;
 $r_n(He^+) = 26.4 pm$
- (4) $E_n(Li^{2+}) = -8.72 \times 10^{-16} J$;
 $r_n(Li^{2+}) = 17.6 pm$
 $E_n(He^+) = -19.62 \times 10^{-16} J$;
 $r_n(He^+) = 17.6 pm$

Ans: (1)

Solutions: $E_n \text{He}^+ = -2.18 \times 10^{-18} \frac{Z^2}{n^2} J = -2.18 \times 10^{-18} \frac{2^2}{1^2} J = 8.72 \times 10^{-18} J$

$$E_n \text{Li}^{2+} = -2.18 \times 10^{-18} \frac{Z^2}{n^2} J = -2.18 \times 10^{-18} \frac{3^2}{1^2} J = -19.62 \times 10^{-18} J$$

$$r_n \text{He}^+ = 52.9 \times \frac{n^2}{Z} \text{pm} = 52.9 \times \frac{1^2}{2} \text{pm} = 26.4 \text{pm}$$

$$r_n \text{Li}^{2+} = 52.9 \times \frac{n^2}{Z} \text{pm} = 52.9 \times \frac{1^2}{3} \text{pm} = 17.6 \text{pm}$$

51. Which of the following are paramagnetic?

- A. $[\text{NiCl}_4]^{2-}$ B. $\text{Ni}(\text{CO})_4$
C. $[\text{Ni}(\text{CN})_4]^{2-}$ D. $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
E. $\text{Ni}(\text{PPh}_3)_4$

Choose the correct answer from the options given below:

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

Ans: (3)

Solutions:

- A. $[\text{NiCl}_4]^{2-}$ Paramagnetic (two unpaired electron)
B. $\text{Ni}(\text{CO})_4$ Diamagnetic
C. $[\text{Ni}(\text{CN})_4]^{2-}$ Diamagnetic
D. $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ Paramagnetic (two unpaired electrons)
E. $\text{Ni}(\text{PPh}_3)_4$ Diamagnetic

52. Given below are two statements:

Statement I: Like nitrogen that can form ammonia, arsenic can form arsine.

Statement II: Antimony cannot form antimony pentoxide.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are correct
(2) Both Statement I and Statement II are incorrect
(3) Statement I is correct but Statement II is incorrect
(4) Statement I is incorrect but Statement II is correct

Ans: (3)

Solutions: Factual

53. Which among the following electronic configurations belong to main group elements?

- A. $[\text{Ne}]3s^1$ B. $[\text{Ar}]3d^3 4s^2$
C. $[\text{Kr}]4d^{10} 5s^2 5p^5$ D. $[\text{Ar}]3d^{10} 4s^1$
E. $[\text{Rn}]5f^0 6d^2 7s^2$

Choose the correct answer from the option given below

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

Ans: (2)

Solutions:

A. $[Ne]3s^1$ S block element

C. $[Kr]4d^{10}5s^25p^5$ P block element

Rest all are D block elements.

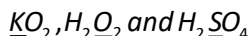
54. Dalton's Atomic theory could not explain which of the following?

- (1) Law of conservation of mass (2) Law of constant proportion
(3) Law of multiple proportion (4) Law of gaseous volume

Ans: (4)

Solutions: Dalton's law does not explain law of gaseous volumes.

55. Consider the following compounds:



The oxidation states of the underlined elements in them are, respectively,

- (1) +1, -1, and +6 (2) +2, -2, and +6 (3) +1, -2, and +4 (4) +4, -4, and +6

Ans: (1)

Solutions: Oxidation number of K in KO_2 compound is +1

Oxidation number of O in H_2O_2 compound is -1

Oxidation number of S in H_2SO_4 compound is +6

56. If the half-life ($t_{1/2}$) for a first order reaction is 1 minute, then the time required for 99.9% completion of the reaction is-closest to:

- (1) 2 minutes (2) 4 minutes (3) 5 minutes (4) 10 minutes

Ans: (4)

Solutions: time required for 99.9% completion of the first order reaction is 10 times of ($t_{1/2}$)

57. The correct order of the wavelength of light absorbed by the following complexes is,



Choose the correct answer from the options given below:

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

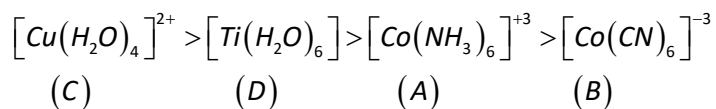
Ans: (2)

Solutions: Order of crystal field splitting energy



(i.e., order of Δ_o)

\therefore Order of wavelength of light absorbed:-

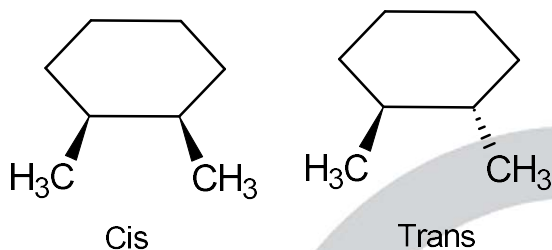


58. Which one of the following compounds can exist as cis-trans isomers?

- (1) Pent-1-ene (2) 2-Methylhex-2-ene
(3) 1,1-Dimethylcyclopropane (4) 1,2-Dimethylcyclohexane

Ans: (4)

Solutions: Only 1, 2 dimethylcyclohexane will show geometrical isomerism



59. Phosphoric acid ionizes in three steps with their ionization constant values

K_{a_1} , K_{a_2} and K_{a_3} , respectively

while K is the overall ionization constant. Which of the following statements are true?

- A. $\log K = \log K_{a_1} + \log K_{a_2} + \log K_{a_3}$
B. H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-} .
C. $K_{a_1} > K_{a_2} > K_{a_3}$
D. $K_{a_1} = \frac{K_{a_3} + K_{a_2}}{2}$

- (1) A and B only (2) A and C only (3) B, C and D only (4) A, B and C only

Ans: (4)

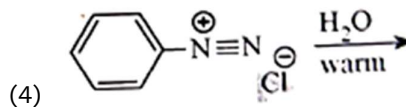
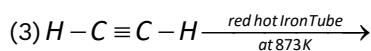
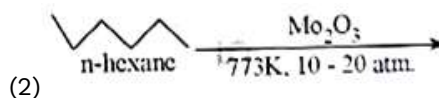
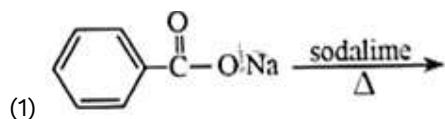
Solutions: $K = K_{a_1} \times K_{a_2} \times K_{a_3}$

$$\therefore \log K = \log K_{a_1} + \log K_{a_2} + \log K_{a_3}$$

H_3PO_4 is a stronger acid than $H_2PO_4^-$ and HPO_4^{2-} .

$$K_{a_1} > K_{a_2} > K_{a_3}$$

60. Which one of the following reactions does NOT give benzene as the product?



Ans : (4)

Solutions : In 4th option phenol is the product and rest in all cases benzene is the product.

61. If the molar conductivity (Λ_m) of a 0.050 mol/L^{-1} solution of a monobasic weak acid is $90 \text{ S cm}^2 \text{ mol}^{-1}$, its extent (degree) of dissociation will be

[Assume $\Lambda_+^\circ = 349.6 \text{ S cm}^2 \text{ mol}^{-1}$ and $\Lambda_-^\circ = 50.4 \text{ S cm}^2 \text{ mol}^{-1}$.]

- (1) 0.115 (2) 0.125 (3) 0.225 (4) 0.215

Ans : (3)

Solutions :

$$\Lambda_m = 90$$

$$C = 0.05$$

$$\Lambda_m^\infty = 349.6 + 50.4$$

$$= 400$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\infty} = \frac{90}{400} = 0.225$$

62. Given below are two statements

Statement I : A hypothetical diatomic molecule with bond order zero is quite stable.

Statement II: As bond order increases, the bond length increases.

In the light of the above statements, choose the most appropriate answer from the options given below :

- (1) Both Statement I and Statement II are true
 (2) Both Statement I and Statement II are false
 (3) Statement I is true but Statement I is false
 (4) Statement I is false but Statement II is true

Ans: (2)

Solutions: As Bond Order increases, bond length decreases and stability increases
 Molecule with bond order zero is non-existent.

63. Out of the following complex compounds, which of the compound will be having the minimum conductance in solution?

- (1) $[Co(NH_3)_3 Cl_3]$ (2) $[Co(NH_3)_4 Cl_2]$ (3) $[Co(NH_3)_6] Cl_3$ (4) $[Co(NH_3)_5 Cl] Cl$

Ans: (1, 2)

Solutions: Complex 1 and 2 do not dissociate and hence do not produce any ions. Therefore, their conductance is minimum.

64. Match List -I with List -II

	List I		List II
A.	XeO_3	I.	sp^3d ; linear
B.	XeF_2	II.	sp^3 ; pyramidal
C.	XeOF_4	III.	sp^3d^3 ; distorted octahedral
D.	XeF_6	IV.	sp^3d^2 ; square pyramidal

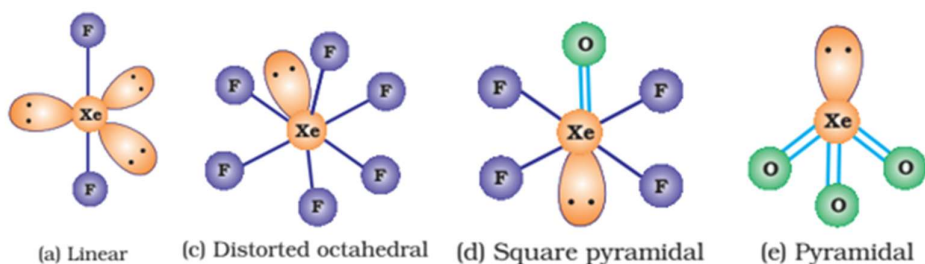
Choose the correct answer from the options given below

(1) A-II, B-I, C-IV, D-III (2) A-II, B-I, C-III, D-IV

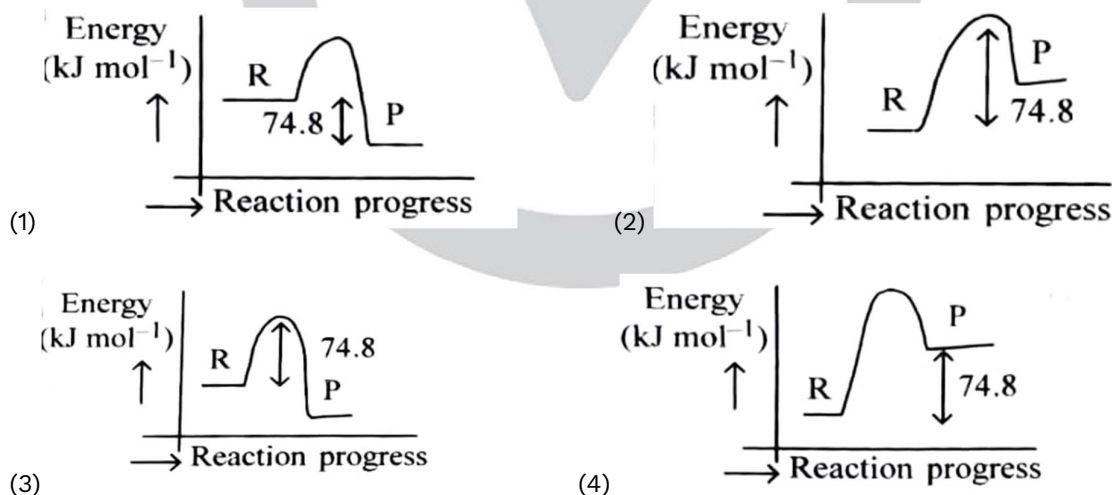
(3) A-IV, B-II, C-III, D-I (4) A-IV, B-II, C-I, D-III

Ans : (1)

Solutions :



65. $\text{C}(s) + 2\text{H}_2(g) \rightarrow \text{CH}_4(g)$; $\Delta H = -74.8 \text{ kJ mol}^{-1}$ Which of the following diagrams gives an accurate representation of the above reaction?
[R \rightarrow reactants; P \rightarrow products]



Ans : (1)

Solutions : $\Delta H = E_p - E_r$

$E_p < E_r$ (as $\Delta H < 0$)

66. Match List -I with List -II

	List-I (Example)		List-II (Type of Solution)
A.	Humidity	I.	Solid in solid
B.	Alloys	II.	Liquid in gas
C.	Amalgams	III.	Solid in gas

	List I (Name of Vitamin)		List II (Deficiency disease)
A.	Vitamin B_{12}	I.	Cheilosis
B.	Vitamin D	II.	Convulsions
C.	Vitamin B_2	III.	Rickets
D.	Vitamin B_6	IV.	Pernicious anaemia

Choose the correct answer from the options given below:

- (1) A-I, B-III, C-II, D-IV (2) A-IV, B-III, C-I, D-II
 (3) A-II, B-III, C-I, D-IV (4) A-IV, B-III, C-II, D-I

Ans : (2)

Solutions :

Table 10.3: Some important Vitamins, their Sources and their Deficiency Diseases

Sl. No.	Name of Vitamins	Sources	Deficiency diseases
1.	Vitamin A	Fish liver oil, carrots, butter and milk	Xerophthalmia (hardening of cornea of eye) Night blindness
2.	Vitamin B_1 (Thiamine)	Yeast, milk, green vegetables and cereals	Beri beri (loss of appetite, retarded growth)
3.	Vitamin B_2 (Riboflavin)	Milk, eggwhite, liver, kidney	Cheilosis (fissuring at corners of mouth and lips), digestive disorders and burning sensation of the skin.
4.	Vitamin B_6 (Pyridoxine)	Yeast, milk, egg yolk, cereals and grams	Convulsions
5.	Vitamin B_{12}	Meat, fish, egg and curd	Pernicious anaemia (RBC deficient in haemoglobin)
6.	Vitamin C (Ascorbic acid)	Citrus fruits, amla and green leafy vegetables	Scurvy (bleeding gums)
7.	Vitamin D	Exposure to sunlight, fish and egg yolk	Rickets (bone deformities in children) and osteomalacia (soft bones and joint pain in adults)

Ref. NCERT (Biomolecules)

70. The correct order of decreasing acidity of the following aliphatic acids is :

- (1) $(CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3COOH > HCOOH$
 (2) $CH_3COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH > HCOOH$
 (3) $HCOOH > CH_3COOH > (CH_3)_2CHCOOH > (CH_3)_3CCOOH$
 (4) $HCOOH > (CH_3)_3CCOOH > (CH_3)_2CHCOOH > CH_3COOH$

Ans: (3)

Solutions: As +I effect increases acidic strength decreases.

71. Given below are two statements:

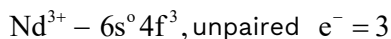
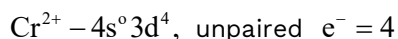
Statement I : Ferromagnetism is considered as an extreme form of paramagnetism.

Statement II: The number of unpaired electrons in a Cr^{2+} ion ($Z = 24$) is the same as that of a Nd^{3+} ion ($Z = 60$)

- (1) Both Statement I and Statement II are true
 (2) Both Statement I and Statement II are false
 (3) Statement I is true but Statement II is false
 (4) Statement I is false but Statement II is true

Ans: (3)

Solutions: Ferromagnetism is considered as an extreme form of paramagnetism.



72. Match List I with List II

	List-I (Mixture)		List-II (Method of separation)
A.	$\text{CHCl}_3 + \text{C}_6\text{H}_5\text{NH}_2$	I.	Distillation under reduced pressure
B.	Crude oil in petroleum industry	II.	Steam distillation
C.	Glycerol from spent-lye	III.	Fractional distillation
D.	Aniline -water	IV.	Simple distillation

Choose the correct answer from the options given below:

- (1) A-IV, B-III, C-I, D-II (2) A-IV, B-III, C-II, D-I
 (3) A-III, B-IV, C-I, D-II (4) A-III, B-IV, C-II, D-I

Ans: (1)

Solutions: A. CHCl_3 and $\text{C}_6\text{H}_5\text{NH}_2$ mixture is separated by simple distillation.

B. Crude oil in petroleum industry is separated by fractional distillation.

C. Glycerol from spent-lye is separated by distillation under reduced pressure.

D. Aniline from water is separated by steam distillation.

73. For the reaction $\text{A(g)} \rightleftharpoons 2\text{B(g)}$, the backward reaction rate constant is higher than the forward reaction rate constant by a factor of 2500, at 1000 K.

[Given: $R = 0.0831 \text{ L atm mol}^{-1}\text{K}^{-1}$]

K_p for the reaction at 1000 K is

- (1) 83.1 (2) 2.077×10^5 (3) 0.033 (4) 0.021

Ans: (3)

Solutions:

$$K_b = 2500 K_f$$

$$\frac{K_f}{K_b} = K_c = \frac{1}{2500}$$

Now,

$$K_p = K_c (RT)^{\Delta n_g}$$

$$K_p = \frac{1}{2500} (0.0831 \times 1000)^1$$

$$= 0.03324$$

74. Given below are two statements

Statement I : Benzenediazonium salt is prepared by the reaction of aniline with nitrous acid at 273 -278 K. It decomposes easily in the dry state.

Statement II : Insertion of iodine into the benzene ring is difficult and hence iodobenzene is prepared through the reaction of benzenediazonium salt with KI.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are correct
 (2) Both Statement I and Statement II are incorrect

- (3) Statement I is correct but Statement II is incorrect
 (4) Statement I is incorrect but Statement II is correct

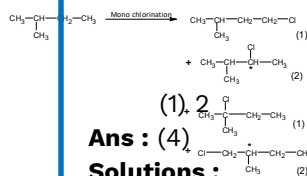
Ans: (1)

Solutions: Benzene diazonium salt is prepared by reacting aniline with HNO_2 at $0-5^\circ\text{C}$.

Diazonium salts decomposes on drying or heating due to low stability.

Iodobenzene is prepared from benzene diazonium salt and KI.

75. How many products (including stereoisomers) are expected from monochlorination of the following compound?



(1), 2

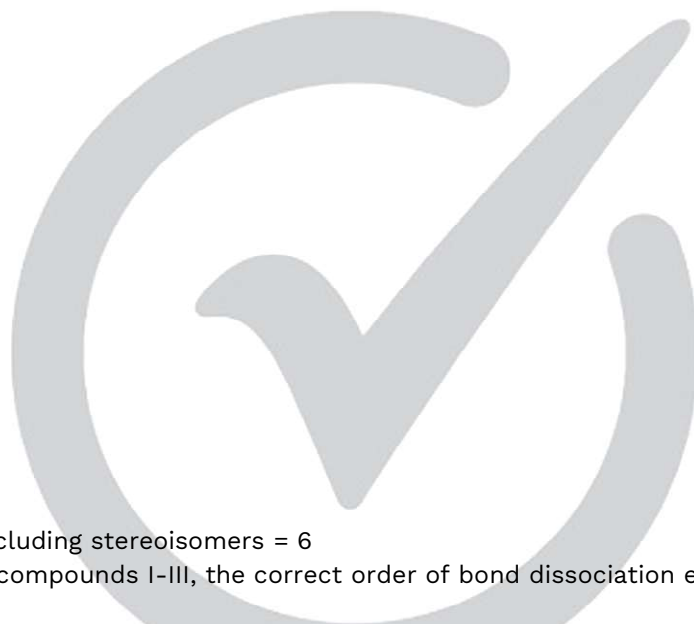
(2)3

(3)5

(4)6

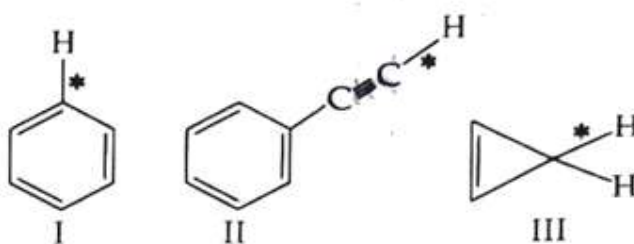
Ans : (4)

Solutions :



Total products including stereoisomers = 6

76. Among the given compounds I-III, the correct order of bond dissociation energy of C-H bond marked with * is



(2) I > II > III

(3) III > II > I

(4) II > III > I

Ans : (1)

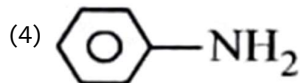
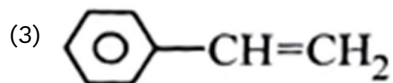
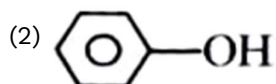
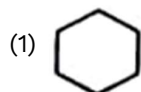
Solutions :

As the percentage s-character in C-H bond increases, bond dissociation energy of C-H bond increases.

So,

(Bond enthalpy order)

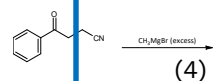
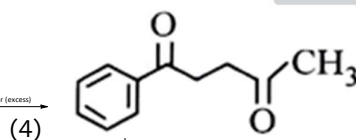
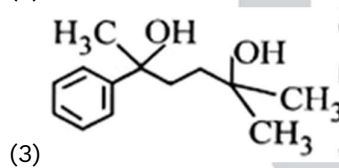
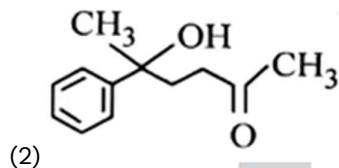
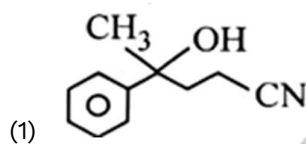
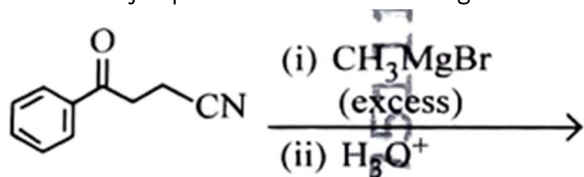
77. Which one of the following compounds does not decolourize bromine water?



Ans: (1)

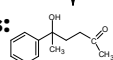
Solutions: Cyclohexane does not react with bromine water as its ring is stable. While all other react with bromine water so decolorize it.

78. The major product of the following reaction is :



Ans: (2)

Solutions:



79. Which of the following aqueous solution will exhibit highest boiling point?

- (1) 0.01M Urea (2) 0.01M KNO_3 (3) 0.01M Na_2SO_4 (4) 0.015M $C_6H_{12}O_6$

Ans: (3)

Solutions: Elevation in boiling point, $\Delta T_b = iK_b m$

So; Boiling point will be highest for solution having highest $i \times m$ i. e. 0.01 M Na_2SO_4

80. Match List -I with List -II

	List- I		List - II
A.	Haber process	I.	Fe catalyst
B.	Wacker oxidation	II.	$PdCl_2$
C.	Wilkinson catalyst	III.	$[(PPh_3)_3 RhCl]$
D.	Ziegler catalyst	IV.	$TiCl_4$ with $Al(CH_3)_3$

Choose the correct answer from the options given below :

- (1) A-I, B-II, C-IV, D-III (2) A-II, B-III, C-I, D-IV
 (3) A-I, B-II, C-III, D-IV (4) A-I, B-IV, C-III, D-II

Ans: (3)

Solutions: A. Catalyst in Haber process is Fe

B. $PdCl_2$ is an oxidizing agent in Wacker process.

C. $[(PPh_3)_3 RhCl]$ is known as Wilkinson catalyst

D. $TiCl_4 + Al(CH_3)_3$ is known as Ziegler catalyst

81. 5 moles of liquid X and 10 moles of liquid Y make a solution having a vapour pressure of 70 torr. The vapour pressures of pure X and Y are 63 torr and 78 torr respectively. Which of the following is true regarding the described solution?

- (1) The solution shows positive deviation.
 (2) The solution shows negative deviation.
 (3) The solution is ideal.
 (4) The solution has volume greater than the sum of individual volumes.

Ans: (2)

Solutions:

$$P_s = P_A^0 X_A + P_B^0 X_B$$

$$P_s = 63 \times \frac{5}{15} + 78 \times \frac{10}{15}$$

$$P_s = 63 \times \frac{1}{3} + 78 \times \frac{2}{3}$$

$$P_s = 21 + 26 \times 2 = 73$$

$$(P_s)_{\text{experimental}} = 70 \text{ torr}$$

$$(P_s)_{\text{theroretical}} > (P_s)_{\text{experimental}}$$

So negative deviation

82. Sugar 'X'

- A. is found in honey.
 B. is a keto sugar.
 C. exists in α and β - anomeric forms.
 D. is laevorotatory.

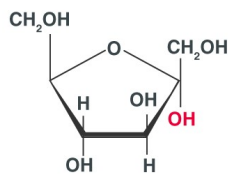
'X' is :

- (1) D-Glucose (2) D-Fructose (3) Maltose (4) Sucrose

Ans : (2)

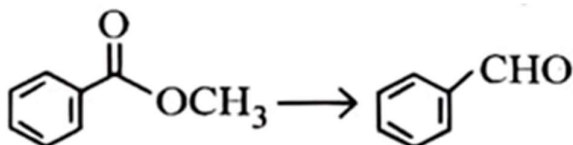
Solutions :

D-Fructose present in honey and also have keto sugar and also exist in α and β anomeric forms



α -D- Fructose

83. Identify the suitable reagent for the following conversion.



- (1) (i) LiAlH_4 , (ii) $\text{H}^+ / \text{H}_2\text{O}$ (2) (i) $\text{AlH}(\text{iBu})_2$ (ii) H_2O
 (3) (i) NaBH_4 , (ii) $\text{H}^+ / \text{H}_2\text{O}$ (4) $\text{H}_2 / \text{Pd} - \text{BaSO}_4$

Ans : (2)

Solutions: (i) $\text{AlH}(\text{iBu})_2$ (ii) H_2O reduces ester into aldehyde.

84. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : _____ undergoes $\text{S}_{\text{N}}2$ reactions faster than _____

Reason (R) : Iodine is a better leaving group because of its large size.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both A and R are true and R is the correct explanation of A
 (2) Both A and R are true but R is not the correct explanation of A
 (3) A is true but R is false
 (4) A is false but R is true

Ans : (1)

Solutions :

In Assertion both alkyl halide are 1° so Iodine is a better leaving group because of its large size. So give better $\text{S}_{\text{N}}2$ reaction

85. The standard heat of formation, in kcal/mol of Ba^{2+} is:

[Given : standard heat of formation of SO_4^{2-} ion (aq) = -216 kcal/mol , standard heat of crystallisation of $\text{BaSO}_4(\text{s}) = -4.5 \text{ kcal/mol}$, standard heat of formation of

$\text{BaSO}_4(\text{s}) = -349 \text{ kcal/mol}$]

- (1) -128.5 (2) -133.0 (3) $+133.0$ (4) $+220.5$

Ans : (1)

Solutions :

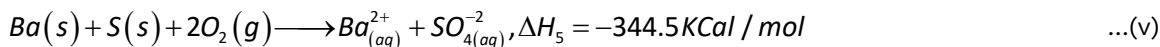
$\text{Ba}(\text{s}) + \text{S}(\text{s}) + 2\text{O}_2(\text{g}) \rightarrow \text{BaSO}_4(\text{s})$ $\Delta H_1 = -349 \text{ kcal/mol}$ (standard heat of formation of $\text{BaSO}_4(\text{s})$)
 ..(i)

$\text{Ba}_{(\text{aq})}^{2+} + \text{SO}_{4(\text{aq})}^{2-} \longrightarrow \text{BaSO}_4(\text{s})$, $\Delta H_2 = -4.5 \text{ KCal/mol}$ (standard heat of crystallization) ..(ii)

$\text{S}(\text{s}) + 2\text{O}_2(\text{g}) + \text{aq.} + 2\text{e}^- \longrightarrow \text{SO}_{4(\text{aq})}^{2-}$, $\Delta H_3 = -216 \text{ KCal/mol}$..(iii)

$\text{Ba}(\text{s}) + \text{aq.} \longrightarrow \text{Ba}_{(\text{aq})}^{2+} + 2\text{e}^-$, $\Delta H_4 = ?$...(iv)

Equation (i) – Eq. (ii), we get



Now, Equation (v) – Eq. (iii), we get

$$\Delta H_4 = -128.5 \text{ KCal / mol}$$

86. Total number of possible isomers (both structural as well as stereoisomers) of cyclic ethers of molecular formula $\text{C}_4\text{H}_8\text{O}$ is:

(1) 6

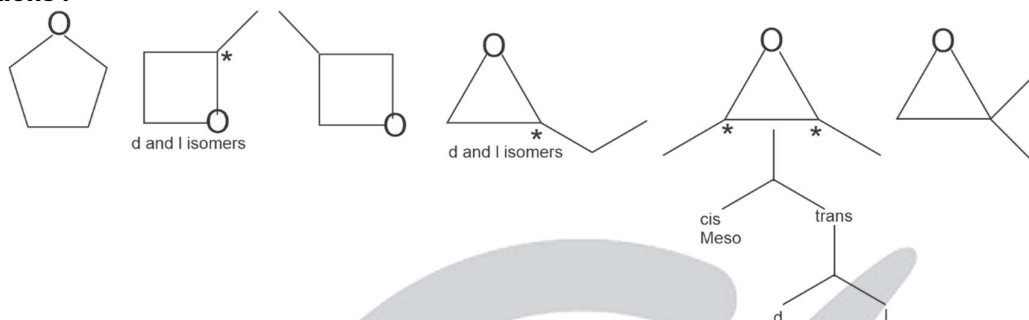
(2) 8

(3) 10

(4) 11

Ans : (3)

Solutions :



Total 10 isomers

87. Identify the correct orders against the property mentioned

- A. $\text{H}_2\text{O} > \text{NH}_3 > \text{CHCl}_3$ – dipole moment
 B. $\text{XeF}_4 > \text{XeO}_3 > \text{XeF}_2$ – number of lone pairs on central atom
 C. $\text{O}-\text{H} > \text{C}-\text{H} > \text{N}-\text{O}$ – bond length
 D. $\text{N}_2 > \text{O}_2 > \text{H}_2$ – bond enthalpy

Choose the correct answer from the options given below :

(1) A, D only

(2) B, D only

(3) A, C only

(4) B, C only

Ans : (1)

Solutions :

A. $\text{H}_2\text{O} > \text{NH}_3 > \text{CHCl}_3$ – dipole moment option is correct

Option B is wrong. Number of lone pairs central atom $\text{XeF}_2 = 3$, $\text{XeO}_3 = 1$, $\text{XeF}_4 = 2$

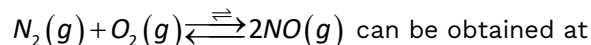
C. $\text{O}-\text{H} > \text{C}-\text{H} > \text{N}-\text{O}$ – bond length

The correct order of bond lengths from shortest to longest is $\text{O}-\text{H} < \text{C}-\text{H} < \text{N}-\text{O}$.

D. $\text{N}_2 > \text{O}_2 > \text{H}_2$ – bond enthalpy

This is because N_2 has a triple bond, O_2 has a double bond, and H_2 has a single bond, and generally, multiple bonds have higher enthalpy than single bonds.

88. Higher yield of NO in



$$[\Delta H \text{ of the reaction} = +180.7 \text{ kJ mol}^{-1}]$$

A. higher temperature

B. lower temperature

C. higher concentration of N_2

D. higher concentration of O_2

Choose the correct answer from the options given below:

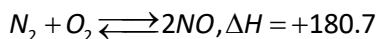
(1) A, D only

(2) B, C only

(3) B, C, D only

(4) A, C, D only

Ans : (4)

Solutions :

According to Le-chatelier principle-

Reaction is Endothermic, so on increasing Temperature reaction will move in forward direction.

If Concentration of reactant will increase so reaction will move in forward direction. So increasing the Concentration of N_2 and O_2 will favour higher yield of NO.

89. If the rate constant of a reaction is $0.03 s^{-1}$ how much time does it take for $7.2 mol L^{-1}$ concentration of the reactant to get reduced to $0.9 mol L^{-1}$?

(Given: $\log 2 = 0.301$)

- (1) 69.3 s (2) 23.1 s (3) 210 s (4) 21.0 s

Ans : (1)

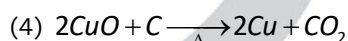
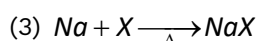
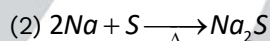
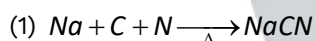
Solutions :

$$k = \frac{2.303}{t} \log \frac{A_0}{A_t}$$

$$0.03 = \frac{2.303}{t} \log \frac{7.2}{0.9}$$

$$t = \frac{2.303}{0.03} \log 8 = \frac{2.303}{0.03} \times 3 \log 2 = 69.3 \text{ sec}$$

90. Which one of the following reactions does NOT belong to Lassaigne's test"?



Ans : (4)

Solutions : In Lassaigne test, substance is heated with sodium metal.

BIOLOGY

91. The complex II of mitochondrial electron transport chain is also known as

- (1) Cytochrome bc_1 (2) Succinate dehydrogenase
(3) Cytochrome c oxidase (4) NADH dehydrogenase

Ans : (2)

92. Polymerase chain reaction (PCR) amplifies DNA following the equation.

- (1) N^2 (2) 2^n (3) $2n + 1$ (4) $2N^2$

Ans : (2)

93. What are the potential drawbacks in adoption of the IVF method?

- A. High fatality risk to mother
- B. Expensive instruments and reagents
- C. Husband / wife necessary for being donors
- D. Less adoption of orphans
- E. Not available in India
- F. Possibility that the early embryo does not survive

Choose the correct answer from the options given below:

- (1) B, D, F only (2) A, C, D, F only (3) A, B, C, D only (4) A, B, C, E, F only.

Ans : (1)

94. What is the name of the blood vessel that carries deoxygenated blood from the body to the heart in a frog?

- (1) Aorta (2) Pulmonary artery (3) Pulmonary vein (4) Vena cave

Ans : (4)

95. Which one of the following statements refers to Reductionist Biology?

- (1) Physico-chemical approach to study and understand living organisms
- (2) Physiological approach to study and understand living organisms.
- (3) Chemical approach to study and understand living organisms
- (4) Behavioural approach to study and understand living organisms.

Ans : (1)

96. Given below are two statements :

Statement I: In the RNA world, RNA is considered the first genetic material evolved to carry out essential life processes. RNA acts as a genetic material and also as a catalyst for some important biochemical reactions in living systems. Being reactive, RNA is unstable.

Statement II: DNA evolved from RNA and is a more stable genetic material. Its double helical strands being complementary, resist changes by evolving repairing mechanism.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are incorrect
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct

Ans : (1)

97. Epiphytes that are growing on a mango branch is an example of which of the following?

- (1) Commensalism (2) Mutualism (3) Predation (4) Amensalism

Ans : (1)

98. From the statements given below choose the **correct** option

- A. The eukaryotic ribosomes are 80S and prokaryotic ribosomes are 70S.
 B. Each ribosome has two sub-units.
 C. The two sub-units of 80S ribosome are 60S and 40S while that of 70S are 50S and 30S.
 D. The two sub-units of 80S ribosome are 60S and 20S and that of 70S are 50S and 20S.
 E. The two sub-units of 80S are 60S and 30S and that of 70S are 50S and 30S.

- (1) A, B, C are true (2) A, B, D are true (3) A, B, E are true (4) B, D, E are true

Ans : (1)

99. Which one of the following is an example of ex-situ conservation?

- (1) National Park (2) Wildlife Sanctuary
 (3) Zoos and botanical gardens (4) Protected areas

Ans : (3)

100. Given below are two statements:

Statement I: The primary source of energy in an ecosystem is solar energy.

Statement II: The rate of production of organic matter during photosynthesis in an ecosystem is called net primary productivity (NPP).

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both statement I and statement II are correct
 (2) Both statement I and statement II are incorrect
 (3) Statement I is correct but statement II is incorrect
 (4) Statement I is incorrect but statement II is correct

Ans : (3)

101. Match **List - I** with **List - II**.

	List - I		List - II
A	Emphysema	I	Rapid spasms in muscle due to low Ca^{++} in body fluid
B	Angina Pectoris	II	Damaged alveolar walls and decreased respiratory surface
C	Glomerulo-nephritis	III	Acute chest pain when not enough oxygen
D	Tetany	IV	Inflammation of glomeruli of kidney

Choose the correct answer from the options given below:

- (1) A – III, B – I, C – IV, D – II (2) A – III, B – I, C – II, D – IV
 (3) A – II, B – IV, C – III, D – I (4) A – II, B – III, C – IV, D – I

Ans : (4)

102. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason. (R)**.

Assertion (A): Both wind and water pollinated flowers are not very colourful and do not produce nectar.

Reason (R): The flowers produce enormous amount of pollen grains in wind and water pollinated flowers.

In the light of the above statements, choose the correct answer from the options given below :

- (1) Both **A** and **R** are true and **R** is the correct explanation of **A**
 (2) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
 (3) **A** is true but **R** is false
 (4) **A** is false but **R** is true

Ans : (2)

103. Which of the following is an example of non-distilled alcoholic beverage produced by yeast?

- (1) Whisky (2) Brandy (3) Beer (4) Rum

Ans : (3)

104. Given below are two statements :

Statement I: In a floral formula \oplus stands for zygomorphic nature of the flower, and \underline{G} stands for inferior ovary.

Statement II: In a floral formula \oplus stands for actinomorphic nature of the flower and \underline{G} stands for superior ovary.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is correct but Statement II is incorrect
- (4) Statement I is incorrect but Statement II is correct

Ans : (4)

105. Streptokinase produced by bacterium streptococcus is used for

- (1) Curd production
- (2) Ethanol production
- (3) Liver disease treatment
- (4) Removing clots from blood vessels

Ans : (4)

106. Which chromosome in the human genome has the highest number of genes?

- (1) Chromosome X
- (2) Chromosome Y
- (3) Chromosome 1
- (4) Chromosome 10

Ans : (3)

107. Which of the following statement is correct about location of the male frog copulatory pad?

- (1) First and Second digit of fore limb
- (2) First digit of hind limb
- (3) Second digit of fore limb
- (4) First digit of the fore limb

Ans : (4)

108. Which one of the following phytohormones promotes nutrient mobilization which helps in the delay of leaf senescence in plants?

- (1) Ethylene
- (2) Gibberellin
- (3) Absciscic acid
- (4) Cytokinin

Ans : (4)

109. While trying to find out the characteristic of a newly found animal, a researcher did the histology of adult animal and observed a cavity with presence of mesodermal tissue towards the body wall but no mesodermal tissue was observed towards the alimentary canal. What could be the possible coelome of that animal ?

- (1) Acoelomate
- (2) Pseudocoelomate
- (3) Schizocoelomate
- (4) Spongocoelomate

Ans : (2)

110. Match **List - I** with **List - II**.

	List - I		List - II
A	Head	I	Enzymes
B	Middle piece	II	Sperm motility
C	Acrosome	III	Energy
D	Tail	IV	Genetic material

Choose the correct answer from the options given below :

- (1) A-IV, B-III, C-I, D-II
- (2) A-IV, B-III, C-II, D-I
- (3) A-III, B-IV, C-II, D-I
- (4) A-III, B-II, C-I, D-IV

Ans : (1)

111. Given below are the stages in the life cycle of pteridophytes. Arrange the following stages in the correct sequence.

- (A) Prothallus stage
- (B) Meiosis in spore mother cells
- (C) Fertilisation
- (D) Formation of archegonia and antheridia in gametophyte.
- (E) Transfer of antherozoids to the archegonia in presence of water.

Choose the correct answer from the options given below:

- (1) B, A; D, E, C
- (2) B, A, E, C, D
- (3) D, E, C, A, B
- (4) E, D, C, B, A

Ans : (1)

112. Cardiac activities of the heart are regulated by :

- A. Nodal tissue
- B. A special neural centre in the medulla oblongata
- C. Adrenal medullary hormones
- D. Adrenal cortical hormones

Choose the correct answer from the options given below:

- (1) A, B and C Only (2) A, B, C and D (3) A, C and D Only (4) A, B and D Only

Ans : (1)

113. Which of following organisms *cannot* fix nitrogen?

- A. Azotobacter
- B. Oscillatoria
- C. Anabaena
- D. Volvox
- E. Nostoc

Choose the **correct** answer from the options given below:

- (1) A only (2) D only (3) B only (4) E only

Ans : (2)

114. Given below are two statements:

Statement I: Transfer RNAs and ribosomal RNA do not interact with mRNA.

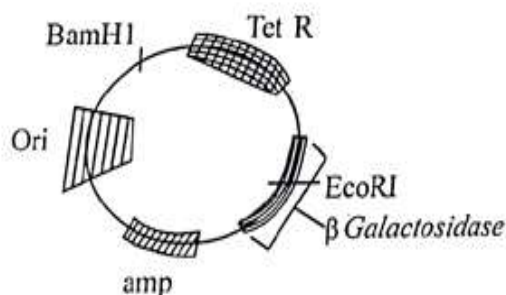
Statement II: RNA interference (RNAi) takes place in all eukaryotic organisms as a method of cellular defence.

In the light of the above statements, choose the **most appropriate** answer from the options given below:

- (1) Both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is correct but Statement II is incorrect
- (4) Statement I is incorrect but Statement II is correct

Ans : (4)

115.



In the above represented plasmid an alien piece of DNA is inserted at EcoRI site. Which of the following strategies will be chosen to select the recombinant colonies?

- (1) Using ampicillin & tetracyclin containing medium plate.
- (2) Blue color colonies will be selected.
- (3) White color colonies will be selected.
- (4) Blue color colonies grown on ampicillin plates can be selected.

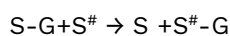
Ans : (3)

116. Which of the following genetically engineered organisms was used by Eli Lilly to prepare human insulin?

- (1) Bacterium
- (2) Yeast
- (3) Virus
- (4) Phage

Ans : (1)

117. Name the class of enzyme that usually catalyze the following reaction:



Where, G \rightarrow a group other than hydrogen

S \rightarrow a substrate

S# another substrate

- (1) Hydrolase
- (2) Lyase
- (3) Transferase
- (4) Ligase

Ans : (3)

118. Find the statement that is **NOT** correct with regard to the structure of monocot stem.

- (1) Hypodermis is parenchymatous.
- (2) Vascular bundles are scattered.
- (3) Vascular bundles are conjoint and closed.
- (4) Phloem parenchyma is absent.

Ans : (1)

119. The correct sequence of events in the life cycle of bryophytes is

- A. Fusion of antherozoid with egg.
- B. Attachment of gametophyte to substratum.
- C. Reduction division to produce haploid spores.
- D. Formation of sporophyte.
- E. Release of antherozoids into water.

Choose the correct answer from the options given below:

- (1) D, E, A, C, B
- (2) B, E, A, C, D
- (3) B, E, A, D, C
- (4) D, E, A, B, C

Ans : (3)

120. Which are correct:

- A. Computed tomography and magnetic resonance imaging detect cancers of internal organs.
- B. Chemotherapeutic drugs are used to kill non-cancerous cells.
- C. α -interferon activates the cancer patients immune system and helps in destroying the tumour.
- D. Chemotherapeutic drugs are biological response modifiers.
- E. In the case of leukaemia blood cell counts are decreased.

Choose the correct answer from the options given below:

- (1) B and D only
- (2) D and E only
- (3) C and D only
- (4) A and C only

Ans : (4)

121. Match **List - I** with **List - II**.

	List - I		List - II
A	Centromere	I	Mitochondrion
B	Cilium	II	Cell division
C	Cristae	III	Cell movement
D	Cell membrane	IV	Phospholipid Bilayer

Choose the **correct** answer from the options given below:

- (1) A-I, B-II, C-III, D-IV
- (2) A-II, B-I, C-IV, D-III
- (3) A-IV, B-II, C-III, D-I
- (4) A-II, B-III, C-I, D-IV

Ans : (4)

122. Match **List - I** with **List - II**.

	List - I		List - II
A	Chlorophyll a	I	Yellow-green
B	Chlorophyll b	II	Yellow
C	Xanthophylls	III	Blue-green
D	Carotenoids	IV	Yellow to Yellow-orange

Choose the option with all correct matches.

- (1) A-III, B-IV, C-II, D-I
- (2) A-III, B-I, C-II, D-IV
- (3) A-I, B-II, C-IV, D-III
- (4) A-I, B-IV, C-III, D-II

Ans : (2)

123. Find the correct statements :

- A. In human pregnancy, the major organ systems are formed at the end of 12 weeks.
- B. In human pregnancy the major organ systems are formed at the end of 8 weeks.
- C. In human pregnancy heart is formed after one month of gestation.
- D. In human pregnancy, limbs and digits develop by the end of second month.
- E. In human pregnancy the appearance of hair is usually observed in the fifth month.

Choose the correct answer from the options given below:

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

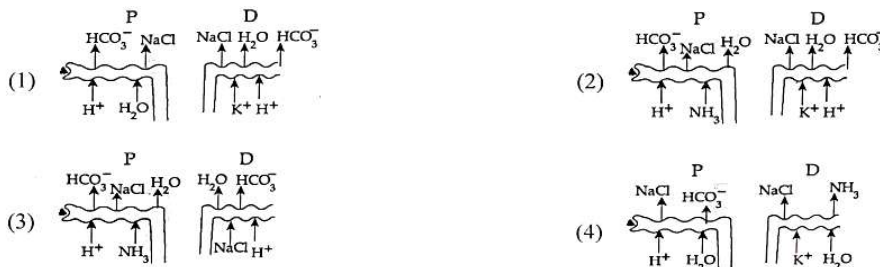
Ans : (4)

124. In the seeds of cereals, the outer covering of endosperm separates the embryo by a protein-rich layer called:

- (1) Coleoptile (2) Coleorhiza (3) Integument (4) Aleurone layer

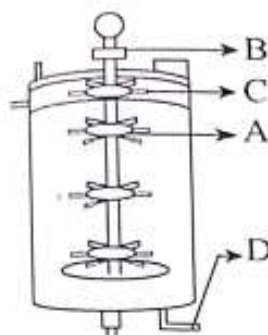
Ans : (4)

125. Which of the following diagrams is correct with regard to the proximal (P) and distal (D) tubule of the Nephron.



Ans : (2)

126. Identify the part of a bio-reactor which is used as a foam braker from the given figure.



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

Ans : (4)

127. Given below are two **statements** :

One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : A typical unfertilised angiosperm embryo sac at maturity is 8 nucleate and 7-celled.

Reason (R) : The egg apparatus has 2 polar nuclei.

In the light of the above statements, choose the **correct** answer from the options given below :

- (1) Both **A** and **R** are true and **R** is the correct explanation of **A**
 (2) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
 (3) **A** is true but **R** is false
 (4) **A** is false but **R** is true

Ans : (3)

128. A specialised membranous structure in a prokaryotic cell which helps in cell wall formation, DNA replication and respiration is :

- (1) Mesosome (2) Chromatophores (3) Cristae (4) Endoplasmic Reticulum

Ans : (1)

129. Which of the following are the post transcriptional events in an eukaryotic cell?

- A. Transport of pre-mRNA to cytoplasm prior to splicing.
 B. Removal of introns and joining of exons.
 C. Addition of methyl group at 5' end of hnRNA.
 D. Addition of adenine residues at 3' end of hnRNA.
 E. Base pairing of two complementary RNAs.

Choose the **correct** answer from the options given below :

- (1) A,B, C only (2) B, C, D only (3) B, C, E only (4) C, D, E only

Ans : (2)

130. What is the pattern of inheritance for polygenic trait?

- (1) Mendelian inheritance pattern
- (2) Non-mendelian inheritance pattern
- (3) Autosomal dominant pattern
- (4) X-linked recessive inheritance pattern

Ans : (2)

131. Which one of the following enzymes contains 'Haem' as the prosthetic group?

- (1) RuBisCo
- (2) Carbonic anhydrase
- (3) Succinate dehydrogenase
- (4) Catalase

Ans : (4)

132. Each of the following characteristics represent a Kingdom proposed by Whittaker. Arrange the following in increasing order of complexity of body organization.

- A. Multicellular heterotrophs with cell wall made of chitin.
- B. Heterotrophs with tissue/organ/organ system level of body organization.
- C. Prokaryotes with cell wall made of polysaccharides and amino acids.
- D. Eukaryotic autotrophs with tissue/organ level of body organization.
- E. Eukaryotes with cellular body organization.

Choose the **correct** answer from the options given below:

- (1) A, C, E, B, D
- (2) C, E, A, D, B
- (3) A, C, E, D, B
- (4) C, E, A, B, D

Ans : (2)

133. Who is known as the father of Ecology in India?

- (1) S. R. Kashyap
- (2) Ramdeo Misra
- (3) Ram Udar
- (4) Birbal Sahni

Ans : (2)

134. Match **List I** with **List II** :

	List - I		List - II
A	Alfred Hershey and Martha Chase	I	Streptococcus pneumoniae
B	Euchromatin	II	Densely packed and dark-stained
C	Frederick Griffith	III	Loosely packed and light-stained
D	Heterochromatin	IV	DNA as genetic material confirmation

Choose the **correct** answer from the options given below:

- (1) A-II, B-IV, C-I, D-III
- (2) A-IV, B-II, C-I, D-III
- (3) A-IV, B-III, C-I, D-II
- (4) A-III, B-II, C-IV, D-I

Ans : (3)

135. Neoplastic characteristics of cells refer to:

- A. A mass of proliferating cell
- B. Rapid growth of cells
- C. Invasion and damage to the surrounding tissue
- D. Those confined to original location

Choose the correct answer from the options given below:

- (1) A, B only
- (2) A, B, C only
- (3) A, B, D only
- (4) B, C, D only

Ans : (2)

136. Given below are two statements :

Statement I : The DNA fragments extracted from gel electrophoresis can be used in construction of recombinant DNA

Statement II : Smaller size DNA fragments are observed near anode while larger fragments are found near the wells in an agarose gel.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are incorrect
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct

Ans : (1)

List I

- A. Adenosine
- B. Adenylic acid
- C. Adenine
- D. Alanine

List II

- I. Nitrogen base
- II. Nucleotide
- III. Nucleoside
- IV. Amino acid

Choose the option with all **correct** matches

(1) A-III, B-IV, C-II, D-I (2) A-III, B-II, C-IV, D-I

(3) A-III, B-II, C-I, D-IV (4) A-II, B-III, C-I, D-IV

138. Consider the following :

- A. The reductive division for the human female gametogenesis starts earlier than that of the male gametogenesis.
- B. The gap between the first meiotic division and the second meiotic division is much shorter for males compared to females.
- C. The first polar body is associated with the formation of the primary oocyte.
- D. Luteinizing Hormone (LH) surge leads to disintegration of the endometrium and onset of menstrual bleeding.

(1) A and B are true
(2) A and C are true
(3) B and D are true
(4) B and C are true

139. All living members of the class Cyclostomata are :
 (1) Free living (2) Endoparasite (3) Symbiotic (4) Ectoparasite

140. Given below are two statements : one is labelled **Assertion (A)** and the other is labelled as **Reason (R)**.

Reason (R) : Vesicles containing materials made by the endoplasmic reticulum fuse with the cis face of the Golgi apparatus, and they are modified and released from the trans face of the Golgi apparatus.

- (1) Both **A** and **R** are true and R is the correct explanation of **A**
- (2) Both **A** and **R** are true but R is not the correct explanation of **A**
- (3) **A** is true but **R** is false
- (4) **A** is false but **R** is true

141. Match **List I** with **List II**

Choose the option with all **correct** matches.

(1) A-II, B-III, C-IV, D-I (2) A-IV, B-III, C-II, D-I
(3) A-IV, B-III, C-I, D-II (4) A-II, B-IV, C-III, D-I

142. Given below are two statements : one is labelled Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : All vertebrates are chordates but all chordates are not vertebrate.

Reason (R) : The members of subphylum vertebrata possess notochord during the embryonic period, the notochord is replaced by a cartilaginous or bony vertebral column in adults.

In the light of the above statements, choose the **correct** answer from the options given below :

- (1) Both **A** and **R** are true and R is the correct explanation of **A**
- (2) Both **A** and **R** are true but R is not the correct explanation of **A**
- (3) **A** is true but **R** is false
- (4) **A** is false but **R** is true

Ans : (1)

143. Identify the statement that is **NOT** correct.

- (1) Each antibody has two light and two heavy chains.
- (2) The heavy and light chains are held together by disulfide bonds
- (3) Antigen binding site is located at C-terminal region of antibody molecules
- (4) Constant region of heavy and light chains are located at C-terminus of antibody molecules.

Ans : (3)

144. Silencing of specific mRNA is possible via RNAi because of -

- (1) Complementary dsRNA
- (2) Inhibitory ssRNA
- (3) Complementary tRNA
- (4) Non-complementary ssRNA

Ans : (1)

145. Genes R and Y follow independent assortment. If RRYy produce round yellow seeds and rryy produce wrinkled green seeds, what will be the phenotypic ratio of the F₂ generation?

- (1) Phenotypic ratio – 1 : 2 : 1
- (2) Phenotypic ratio – 3 : 1
- (3) Phenotypic ratio – 9 : 3 : 3 : 1
- (4) Phenotypic ratio – 9 : 7

Ans : (3)

146. Histones are enriched with -

- (1) Lysine & Arginine
- (2) Leucine & Lysine
- (3) Phenylalanine & Leucine
- (4) Phenylalanine & Arginine

Ans : (1)

147. The first menstruation is called :

- (1) Menopause
- (2) Menarche
- (3) Diapause
- (4) Ovulation

Ans : (2)

148. Match **List – I** with **List – II**

List-I

- A. Heart
- B. Kidney
- C. Gastro-intestinal tract
- D. Adrenal Cortex

List-II

- I. Erythropoietin
- II. Aldosterone
- Atrial natriuretic factor
- IV. Secretin

Choose the **correct** answer from the options given below :

- (1) A-II, B-I, C-III, D-IV
- (2) A-IV, B-III, C-II, D-I
- (3) A-I, B-III, C-IV, D-II
- (4) A-III, B-I, C-IV, D-II

Ans : (4)

149. The protein portion of an enzyme is called :

- (1) Cofactor
- (2) Coenzyme
- (3) Apoenzyme
- (4) Prosthetic group

Ans : (3)

150. Which of the following is the unit of productivity of an Ecosystem?

- (1) gm⁻²
- (2) KCal m⁻²
- (3) KCal m⁻³
- (4) (KCal m⁻²) yr⁻¹

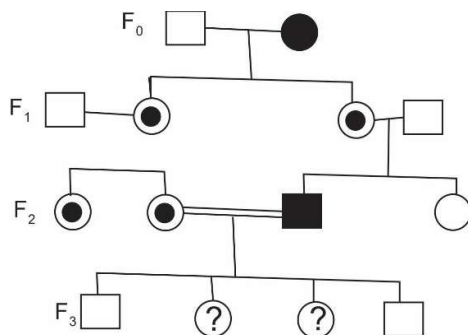
Ans : (4)

151. Sweet potato and potato represent a certain type of evolution. Select the correct combination of terms to explain the evolution.

- (1) Analogy, convergent
- (2) Homology, divergent
- (3) Homology, convergent
- (4) Analogy, divergent

Ans : (1)

152. With the help of given pedigree, find out the probability for the birth of a child having no disease and being a carrier (has the disease mutation in one allele of the gene) in F₃ generation.



□ Unaffected male

■ Affected male

● Carrier female

○ Unaffected female

● Affected female

(1) 1/4

(2) 1/2

(3) 1/8

(4) Zero

Ans : (1)

153. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Cells of the tapetum possess dense cytoplasm and generally have more than one nucleus.

Reason (R) : Presence of more than one nucleus in the tapetum increases the efficiency of nourishing the developing microspore mother cells.

In the light of the above statements, choose the **correct** answer from the options given below :

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

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

(3) **A** is true but **R** is false

(4) **A** is false but **R** is true

Ans : (1)/(3)

154. How many meiotic and mitotic divisions need to occur for the development of a mature female gametophyte from the megaspore mother cell in an angiosperm plant?

(1) 2 Meiosis and 3 Mitosis

(2) 1 Meiosis and 2 Mitosis

(3) 1 Meiosis and 3 Mitosis

(4) No Meiosis and 2 Mitosis

Ans : (3)

155. Which of the following is an example of a zygomorphic flower?

(1) Petunia

(2) Datura

(3) Pea

(4) Chilli

Ans : (3)

156. After maturation, in primary lymphoid organs, the lymphocytes migrate for interaction with antigens to secondary lymphoid organ(s)/tissue(s) like :

A. thymus

B. bone marrow

C. Spleen

D. lymph nodes

E. Peyer's patches

Choose the **correct** answer from the options given below :

(1) B, C, D only

(2) A, B, C only

(3) E, A, B only

(4) C, D, E only

Ans : (4)

157. Given below are two statements :

Statement I : Fig fruit is a non-vegetarian fruit as it has enclosed fig wasps in it.

Statement II : Fig wasp and fig tree exhibit mutual relationship as fig wasp completes its life cycle in fig fruit and fig fruit gets pollinated by fig wasp.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are incorrect
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct

Ans : (3)/(NA)

158. What is the main function of the spindle fibers during mitosis?

- (1) To separate the chromosomes
- (2) To synthesize new DNA
- (3) To repair damaged DNA
- (4) To regulate cell growth

Ans : (1)

159. Which one of the following is the characteristic feature of gymnosperms?

- (1) Seeds are enclosed in fruits
- (2) Seeds are naked
- (3) Seeds are absent
- (4) Gymnosperms have flowers for reproduction

Ans : (2)

160. Consider the following statements regarding function of adrenal medullary hormones :

- A. It causes pupillary constriction
- B. It is a hyperglycemic hormone
- C. It causes piloerection
- D. It increases strength of heart contraction

Choose the **correct** answer from the options given below :

- (1) C and D only
- (2) B, C and D only
- (3) A, C and D only
- (4) D only

Ans : (2)

161. Why can't insulin be given orally to diabetic patients?

- (1) Human body will elicit strong immune response
- (2) It will be digested in Gastro-Intestinal (GI) tract
- (3) Because of structural variation
- (4) Its bio availability will be increased

Ans : (2)

162. Match **List I** with **List II**.

List – I

- A. Pteridophyte
- B. Bryophyte
- C. Angiosperm
- D. Gymnosperm

List – II

- I. *Salvia*
- II. *Ginkgo*
- III. *Polytrichum*
- IV. *Salvinia*

Choose the option with all **correct** matches

- (1) A-III, B-IV, C-II, D-I
- (2) A-IV, B- III, C-I, D-II
- (3) A-III, B-IV, C-I, D-II
- (4) A-IV, B-III, C-II, D-I

Ans : (2)

163. Who proposed that the genetic code for amino acids should be made up of three nucleotides?

- (1) George Gamow
- (2) Francis Crick
- (3) Jacques Monod
- (4) Franklin Stahl

Ans : (1)

164. Match **List I** with **List II**

List I

- A. The Evil Quartet
- B. Ex situ conservation
- C. *Lantana camara*
- D. Dodo

List II

- I. Cryopreservation
- II. Alien species invasion
- III. Causes of biodiversity losses
- IV. Extinction

Choose the option with all correct matches

(1) A-III, B-II, C-I, D-IV (2) A-III, B-I, C-II, D-IV (3) A-III, B-IV, C-II, D-I (4) A-III, B-II, C-IV, D-I

Ans : (2)

165. Which of the following hormones released from the pituitary is actually synthesized in the hypothalamus?

- (1) Luteinizing hormone (LH)
- (2) Anti-diuretic hormone (ADH)
- (3) Follicle-stimulating hormone (FSH)
- (4) Adenocorticotrophic hormone (ACTH)

Ans : (2)

166. Role of the water vascular system in Echinoderms is :

- A. Respiration and Locomotion
- B. Excretion and Locomotion
- C. Capture and transport of food
- D. Digestion and Respiration
- E. Digestion and Excretion

Choose the **correct** answer from the options given below :

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

Ans : (2)

167. Which of the following type of immunity is present at the time of birth and is a non-specific type of defense in the human body?

- (1) Acquired Immunity
- (2) Innate Immunity
- (3) Cell-mediated Immunity
- (4) Humoral Immunity

Ans : (2)

168. In bryophytes, the gemmae help in which one of the following

- (1) Sexual reproduction
- (2) Asexual reproduction
- (3) Nutrient absorption
- (4) Gaseous exchange

Ans : (2)

169. In frog, the Renal portal system is a special venous connection that acts to link :

- (1) Liver and intestine
- (2) Liver and kidney
- (3) Kidney and intestine
- (4) Kidney and lower part of body

Ans : (4)

170. Given below are two statements :

Statement I : In ecosystem, there is unidirectional flow of energy of sun from producers to consumers.

Statement II : Ecosystems are exempted from 2nd law of thermodynamics.

In the light of the above statements, choose the **most appropriate** answer from the options given below:

- (1) Both statement I and statement II are correct
- (2) Both statement I and statement II are correct
- (3) Statement I is correct but statement II is incorrect
- (4) Statement I is incorrect but statement II is correct

Ans : (3)

171. Which of the following statements about RuBisCO is true?

- (1) It is active only in the dark.
- (2) It has higher affinity for oxygen than carbon dioxide
- (3) It is an enzyme involved in the photolysis of water
- (4) It catalyzes the carboxylation of RuBP.

Ans : (4)

172. Which of the following enzyme(s) are **NOT** essential for gene cloning?

B. Relaxin

II. Ovary

C. Melanocyte stimulating hormone

III. Adrenal Medulla

D. Catecholamines

IV. Corpus luteum

Choose the **correct** answer from the options given below :

(1) A-IV, B-II, C-I, D-III (2) A-IV, B-II, C-III, D-I

(3) A-II, B-IV, C-I, D-III (4) A-III, B-II, C-IV, D-I

Ans : (1)

179. The blue and white selectable markers have been developed which differentiate recombinant colonies from non-recombinant colonies on the basis of their ability to produce colour in the presence of a chromogenic substrate.

Given below are two statements about this method :

Statement I : The blue coloured colonies have DNA insert in the plasmid and they are identified as recombinant colonies.

Statement II : The colonies without blue colour have DNA insert in the plasmid and are identified as recombinant colonies.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

(1) Both statement I and statement II are correct

(2) Both statement I and statement II are incorrect

(3) Statement I is correct but statement II is incorrect

(4) Statement I is incorrect but statement II is correct

Ans : (4)

180. Which one of the following equations represents the Verhulst-Pearl Logistic Growth of population?

(1) $\frac{dN}{dt} = r \left(\frac{K - N}{K} \right)$

(2) $\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$

(3) $\frac{dN}{dt} = rN \left(\frac{N - K}{N} \right)$

(4) $\frac{dN}{dt} = N \left(\frac{r - K}{K} \right)$

Ans : (2)