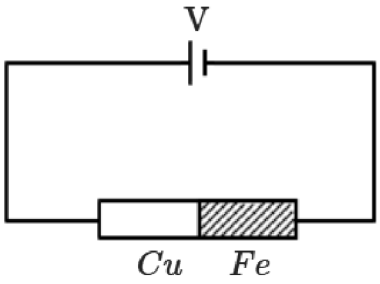
PHYSICS

1 In Young's-double slit experiment, the distance between the slits and the screen is doubled. The separation between the slits is reduced to half. As a result the fringe width:

1.	is halved
2.	become four times
3.	remains unchanged
4.	is doubled

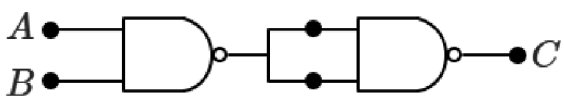
2 Two rods are joined end to end, as shown. Both have a cross-sectional area of 0.01 cm^2. Each is 1 m long. One rod is of copper with a resistivity of 1.7×10^{-6} Ω-cm, the other is of iron with a resistivity of 10^{-5} Ω-cm. How much voltage is required to produce a current of 1 A in the rods?



1. 0.00145 V
2. 0.0145 V
3. 1.7×10^{-6} V
4. 0.117 V

3 A long straight wire carries a certain current and produces a magnetic field 2×10^{-4} Wb/m^2 at a perpendicular distance of 5 cm from the wire. An electron situated at 5 cm from the wire moves with a velocity 10^7 m/s towards the wire along perpendicular to it. The force experienced by the electron will be:
(The charge on electron = 1.6×10^{-19} C)
1. 3.2 N
2. 3.2×10^{-16} N
3. 1.6×10^{-16} N
4. zero

4 The output from a NAND gate is divided into two in parallel and fed to another NAND gate. The resulting gate is a:



1. AND gate
2. NOR gate
3. OR gate
4. NOT gate

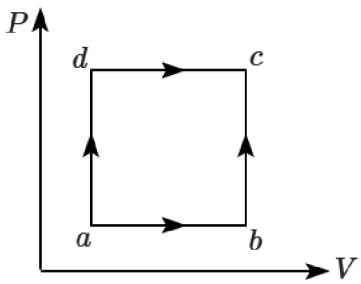
5 The ratio of radii of gyration of a circular ring and a circular disc, of the same mass and radius, about an axis passing through their centres and perpendicular to their planes are:

1.	$1 : \sqrt{2}$	2.	$3 : 2$
3.	$2 : 1$	4.	$\sqrt{2} : 1$

6 The pair of quantities having the same dimensions are:

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

7 A system is taken from state a to state c by two paths adc and abc as shown in the figure. The internal energy at a is $U_a = 10$ J. Along the path adc the amount of heat absorbed $\delta Q_1 = 50$ J and the work obtained $\delta W_1 = 20$ J whereas along the path abc the heat absorbed $\delta Q_2 = 36$ J. The amount of work along the path abc is:



1.	10 J	2.	12 J
3.	36 J	4.	6 J

8 The primary coil of a transformer, when connected to a 10 V-DC battery, draws a current of 1 mA. The number of turns in the primary and secondary coils are 50 and 100, respectively. The voltage across the secondary coil and the current drawn by the circuit in the secondary are respectively:

1.	20 V and 2.0 mA
2.	10 V and 0.5 mA
3.	zero and therefore no current
4.	20 V and 0.5 mA

9 How does the binding energy per nucleon vary with the increase in the number of nucleons?

1.	decrease continuously with mass number.
2.	first decreases and then increases with an increase in mass number.
3.	first increases and then decreases with an increase in mass number.
4.	increases continuously with mass number.

10 The length of a wire between the two ends of a sonometer is 100 cm. What should be the positions of two bridges below the wire so that the three segments of the wire have their fundamental frequencies in the ratio 1 : 3 : 5?

1.	$\frac{1500}{23}$ cm, $\frac{500}{23}$ cm
2.	$\frac{1500}{23}$ cm, $\frac{300}{23}$ cm
3.	$\frac{300}{23}$ cm, $\frac{1500}{23}$ cm
4.	$\frac{1500}{23}$ cm, $\frac{2000}{23}$ cm

11 An electric dipole of dipole moment p is aligned parallel to a uniform electric field E. The energy required to rotate the dipole by 90° is:

1. p^2E
2. pE
3. infinite
4. pE^2

12 A charge q is placed at the centre of the line joining two equal positive charges Q. The system of the three charges will be in equilibrium, if q is equal to:

1.	$\frac{-Q}{4}$	2.	$\frac{Q}{4}$
3.	$\frac{-Q}{2}$	4.	$\frac{Q}{2}$

13 A car is moving in a circular horizontal track of radius 10 m with a constant speed of 10 m/s. A bob is suspended from the roof of the car by a light wire of length 1.0 m. The angle made by the wire with the vertical is:

1.	$\frac{\pi}{3}$	2.	$\frac{\pi}{6}$
3.	$\frac{\pi}{4}$	4.	0°

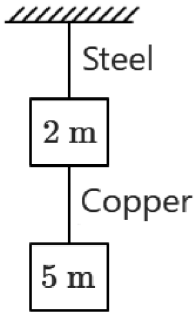
14 A bar magnet of the magnetic moment M is placed at right angles to a magnetic induction B. If a force F is experienced by each pole of the magnet, the length of the magnet will be:

1.	$\frac{MB}{F}$	2.	$\frac{BF}{M}$
3.	$\frac{MF}{B}$	4.	$\frac{F}{MB}$

15 The radius of a planet is twice the radius of the Earth. Both have almost equal average mass densities. If v_P and v_E are escape velocities of the planet and the earth, respectively, then:

1.	$v_P = 1.5v_E$	2.	$v_P = 2v_E$
3.	$v_E = 3v_P$	4.	$v_E = 1.5v_P$

16 If the ratio of diameters, lengths and Young's modulus of steel and copper wires shown in the figure are p, q and s respectively, then the corresponding ratio of increase in their lengths would be:



1.	$\frac{5q}{(7sp^2)}$	2.	$\frac{7q}{(5sp^2)}$
3.	$\frac{2q}{(5sp)}$	4.	$\frac{7q}{(5sp)}$

17 A parallel beam of light of wavelength λ is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the second minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is:

1.	2π	2.	3π
3.	4π	4.	$\pi\lambda$

18 A particle of mass m is kept at rest at a height $3R$ from the surface of the Earth, where R is the radius of the Earth and M is the mass of the Earth. The minimum speed with which it should be projected, so that it does not return, is:
(where g is the acceleration due to gravity on the surface of the Earth)

1.	$\left(\frac{GM}{2R}\right)^{\frac{1}{2}}$	2.	$\left(\frac{gR}{4}\right)^{\frac{1}{2}}$
3.	$\left(\frac{2g}{R}\right)^{\frac{1}{2}}$	4.	$\left(\frac{GM}{R}\right)^{\frac{1}{2}}$

19 A current of 2.5 A flows through a coil of inductance 5 H. The magnetic flux linked with the coil is:
1. 0.5 Wb
2. 12.5 Wb
3. zero
4. 2 Wb

20 The reddish appearance of the sun at sunrise and sunset is due to:

1.	the scattering of light.
2.	the polarisation of light.
3.	the colour of the sun.
4.	the colour of the sky.

21 An electron in hydrogen atom makes a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are principal quantum numbers of the two states. Assuming Bohr's model to be valid, the time period of the electron in the initial state is eight times that in the final state. The possible values of n_1 and n_2 are:

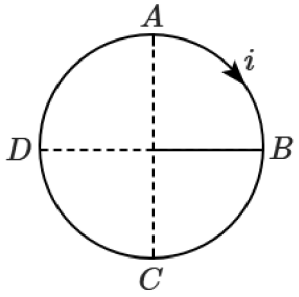
1.	$n_1 = 6$ and $n_2 = 2$
2.	$n_1 = 8$ and $n_2 = 1$
3.	$n_1 = 8$ and $n_2 = 2$
4.	$n_1 = 4$ and $n_2 = 2$

22 A person holding a rifle (mass of person and rifle together is 100 kg) stands on a smooth surface and fires 10 shots horizontally, in 5 s. Each bullet has a mass of 10 g with a muzzle velocity of 800 ms^{-1}. The final velocity acquired by the person and the average force exerted on the person are:
1. -0.08 ms^{-1}; 16 N
2. -0.8 ms^{-1}; 16 N
3. -1.6 ms^{-1}; 16 N
4. -1.6 ms^{-1}; 8 N

23 A gas in a vessel is initially at pressure P. If the mass of all the gas molecules is halved and their speed is doubled, then the resultant pressure will be:

1.	$2P$	2.	P
3.	$\frac{P}{2}$	4.	$4P$

24 A circular coil $ABCD$ carrying a current i is placed in a uniform magnetic field. If the magnetic force on the segment AB is $\vec{F}$, then the force on the remaining segment $BCDA$ is:



1. $-\vec{F}$
2. $3\vec{F}$
3. $-3\vec{F}$
4. $\vec{F}$

25 Two metal rods (1) and (2) of the same length have the same temperature difference between their ends. Their thermal conductivities are K_1 and K_2 and cross-sectional areas A_1 and A_2, respectively. If the rate of heat conduction in (1) is four times that in (2), then:
1. $K_1A_1 = 4K_2A_2$
2. $K_1A_1 = 2K_2A_2$
3. $4K_1A_1 = K_2A_2$
4. $K_1A_1 = K_2A_2$

26 α- particles, β-particles and γ-rays are all having the same energy. Their penetrating power in a given medium in increasing order will be:
1. γ, α, β
2. α, β, γ
3. β, α, γ
4. β, γ, α

27 A source of light is placed at a distance of 50 cm from a photocell and the stopping potential is found to be V_0. If the distance between the light source and photocell is made 25 cm, the new stopping potential will be:

1.	$V_0/2$	2.	V_0
3.	$4V_0$	4.	$2V_0$

28 Vectors $\vec{\mathrm{A}}, \vec{\mathrm{B}}$ and $\vec{\mathrm{C}}$ are such that $\vec{\mathrm{A}} \cdot \vec{\mathrm{B}} = 0$ and $\vec{\mathrm{A}} \cdot \vec{\mathrm{C}} = 0$. Then the vector parallel to $\vec{A}$ is:

1.	$\vec{A} \times \vec{B}$	2.	$\vec{B} + \vec{C}$
3.	$\vec{B} \times \vec{C}$	4.	$\vec{B}$ and $\vec{C}$

29 One way in which the operation of a n-p-n transistor differs from that a p-n-p:

1.	the emitter junction injects minority carriers into the base region of the p-n-p.
2.	the emitter injects holes into the base of the p-n-p and electrons into the base regions of n-p.
3.	the emitter injects holes into the base of n-p-n.
4.	the emitter junction is reversed biased in n-p.

30 Which of the following relations does not give the equation of an adiabatic process, where terms have their usual meaning?

1. $P^{1-\gamma}T^{\gamma} =$ constant
2. $PV^{\gamma} =$ constant
3. $TV^{\gamma-1} =$ constant
4. $P^{\gamma}T^{1-\gamma} =$ constant

31 Two discs are rotating about their respective axes, which are normal to the discs and pass through their centres. Disc D_1 has a 2 kg mass and 0.2 m radius and an initial angular velocity of 50 rad s^{-1}. Disc D_2 has a 4 kg mass, 0.1 m radius and an initial angular velocity of 200 rad s^{-1}. The two discs are brought into contact face to face, with their axes of rotation coincident. The final angular velocity (in rad s^{-1}) of the combined system is:

1. 60
2. 100
3. 120
4. 40

32 The fluid is in streamlined flow through a horizontal pipe with a variable cross-sectional area. Which of the following statements is correct?

1.	The velocity is maximum at the narrowest part of the pipe, and pressure is maximum at the widest part of the pipe.
2.	Both the velocity and pressure are maximum at the narrowest part of the pipe.
3.	Both the velocity and pressure are maximum at the widest part of the pipe.
4.	The velocity is minimum at the narrowest part of the pipe, and the pressure is minimum at the widest part of the pipe.

33 An electromagnetic wave of frequency $\nu = 3.0$ MHz passes from a vacuum into a dielectric medium with relative permittivity $\varepsilon = 4.0$. Then:

1.	wavelength is doubled and frequency becomes half
2.	wavelength is halved and frequency remains unchanged
3.	wavelength and frequency both remain unchanged
4.	wavelength is doubled and frequency unchanged

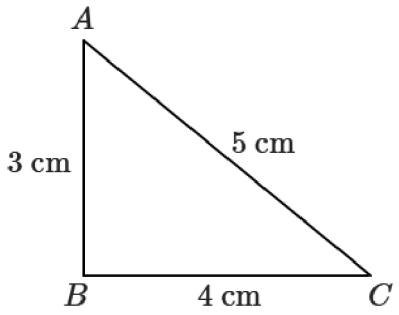
34 A particle with total energy E is moving in a potential energy region $U(x)$. The motion of the particle is restricted to the region where:

1. $U(x) < E$
2. $U(x) = 0$
3. $U(x) \leq E$
4. $U(x) > E$

35 The displacement x (in m) of a particle of mass m (in kg) moving in one dimension under the action of a force, is related to time t (in s) by; $t = (\sqrt{x} + 3)$. The displacement of the particle when its velocity is zero will be:

1.	4 m	2.	zero
3.	6 m	4.	2 m

36 A 12 cm wire is given a shape of a right-angled triangle ABC having sides 3 cm, 4 cm and 5 cm, as shown in the figure. The resistance between two ends (AB, BC, CA) of the respective sides are measured one by one by a multi-meter. The resistances will be in the ratio:



1. 9 : 16 : 25
2. 27 : 32 : 35
3. 21 : 24 : 25
4. 3 : 4 : 5

37 Two sources P and Q produce notes of frequency 660 Hz each. A listener moves from P to Q with a speed of 1 m/s. If The speed of sound is 330 m/s, then number of beats heard by the listener per second will be:
1. 4
2. 8
3. 2
4. zero

38 The de-Broglie wavelength of neutrons in thermal equilibrium at temperature T is:
1. $\frac{3.08}{\sqrt{T}}\ \mathring{A}$
2. $\frac{0.308}{\sqrt{T}}\ \mathring{A}$
3. $\frac{0.0308}{\sqrt{T}}\ \mathring{A}$
4. $\frac{30.8}{\sqrt{T}}\ \mathring{A}$

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

1.	$\frac{T_1 - T_2}{2}$	2.	T_1T_2
3.	$\sqrt{T_1T_2}$	4.	$\frac{T_1 + T_2}{2}$

40 A particle of mass m oscillates along the x-axis according to the equation $x = a\sin\omega t$. The nature of the graph between momentum and displacement of the particle is:

1.	circle
2.	hyperbola
3.	ellipse
4.	a straight line passing through the origin

41 Ten identical cells connected in series are required to heat a wire of length 1 metre and radius r by 10° C in time t. How many cells will be needed to heat a wire of length 2 metres with the same radius by the same temperature in the same time t?

1.	20	2.	30
3.	40	4.	10

42 The density of water at 20°C is 998 kg/m^3 and at 40°C is 992 kg/m^3. The coefficient of volume expansion of water is:
1. $3 \times 10^{-4}/^{\circ}\text{C}$
2. $2 \times 10^{-4}/^{\circ}\text{C}$
3. $6 \times 10^{-4}/^{\circ}\text{C}$
4. $10^{-4}/^{\circ}\text{C}$

43 Two plane mirrors are inclined at 70°. A ray incident on one mirror at an angle θ after reflection falls on the second mirror and is reflected from there parallel to the first mirror. The value of θ is:
1. 45°
2. 30°
3. 55°
4. 50°

44 In an unbiased p-n junction, holes diffuse from the p-regions to n-regions because of:

1.	the attraction of free electrons of the n-region.
2.	the higher hole concentration in the p-region than that in the n-region.
3.	the higher concentration of electrons is in the p-region than that in the n-region.
4.	the potential difference across the p-n junction.

45 One coolie takes 1 minute to raise a suitcase through a height of 2 m but the second coolie takes 30 s to raise the same suitcase to the same height. The powers of two coolies are in the ratio:

1. 1 : 3
2. 2 : 1
3. 3 : 1
4. 1 : 2

CHEMISTRY

46 The outer electronic configuration of Gd:

(At. No. 64)

1. $4f^5\ 5d^4\ 6s^1$
2. $4f^7\ 5d^1\ 6s^2$
3. $4f^3\ 5d^5\ 6s^2$
4. $4f^4\ 5d^5\ 6s^1$

47 Accumulation of lactic acid ($HC_3H_5O_3$ a monobasic acid), in tissues leads to pain and fatigue. In a 0.10 M aqueous solution, lactic acid is 3.7% dissociated. The value of the dissociation constant, K_a, for this acid, will be:

1. 1.4×10^{-5}
2. 1.4×10^{-4}
3. 3.7×10^{-4}
4. 2.8×10^{-4}

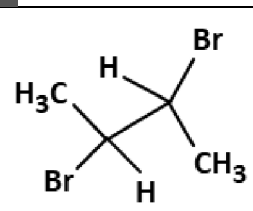
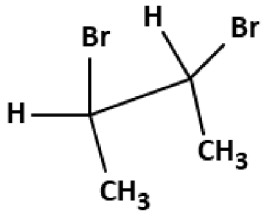
48 For a reaction between A and B the order with respect to A is 2 and the order with respect to B is 3. The concentration of both A and B is doubled the rate will increase by a factor of:

1.	12	2.	16
3.	32	4.	10

49 The metal oxide which cannot be reduced to metal by carbon is:

1. Al_2O_3
2. PbO
3. ZnO
4. Fe_2O_3

50 Given:

	
I	II

I and II are classified as:

1. Identical
2. A pair of conformers
3. A pair of geometrical isomers
4. A pair of optical isomers

51 Crystal field splitting energy for high spin d^4 octahedral complex is:

1.	$-1.2\ \Delta_0$	2.	$-0.6\ \Delta_0$
3.	$-0.8\ \Delta_0$	4.	$-1.6\ \Delta_0$

52 Arrange the following in increasing order of stability:

(a)	$(CH_3)_2\overset{\oplus}{C} - CH_2 - CH_3$
(b)	$(CH_3)_3\overset{\oplus}{C}$
(c)	$(CH_3)_2\overset{\oplus}{C}H$
(d)	$CH_3\overset{\oplus}{C}H_2$
(e)	$\overset{\oplus}{C}H_3$

1.	e < d < c < a < b	2.	d < e < c < a < b
3.	a < e < d < c < b	4.	e < d < c < b < a

53 Consider the half-cell reduction reaction:

$Mn^{2+} + 2e^- \rightarrow Mn,\ E^0 = -1.18\ V$

$Mn^{2+} \rightarrow Mn^{3+} + e^-,\ E^0 = -1.5\ V$

The E^0 for the reaction $3\,Mn^{2+} \rightarrow Mn^0 + 2Mn^{3+}$ and possibility of the forward reaction are respectively:

1.	–4.18 V and Yes	2.	+0.33 V and Yes
3.	+2.69 V and No	4.	–2.69 V and No

54 How many grams of cobalt metal will be deposited when a solution of cobalt (II) chloride is electrolyzed with a current of 10 amperes for 109 minutes?
(1 Faraday = 96,500 C; Atomic mass of Co = 59 u)

1.	4.0	2.	20.0
3.	40.0	4.	0.66

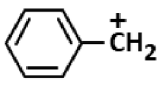
55 In a particular isomer of $[Co(NH_3)_4Cl_2]°$, the Cl–Co–Cl angle is 90°, and the isomer is known as:
1. Optical isomer
2. Cis-isomer
3. Position isomer
4. Linkage isomer

56 Which one of the following statements is not true?

1.	Clean water would have a BOD value of 5 ppm.
2.	Fluoride deficiency in drinking water is harmful. Soluble fluoride is often used to bring its concentration upto 1 ppm.
3.	When the pH of rainwater is higher than 6.5, it is called acid rain.
4.	Dissolved Oxygen (DO) in cold water can reach a concentration upto 10 ppm.

57 When 5 litres of a gas mixture of methane and propane is perfectly combusted at 0°C and 1 atmosphere, 16 litres of oxygen at the same temperature and pressure is consumed. The amount of heat released from this combustion in kJ ($\Delta H_{comb}\cdot (CH_4)$ = 890 kJ mol^{-1}, $\Delta H_{comb}(C_3H_8)$ = 2220 kJ mol^{-1}) is:
1. 38
2. 317
3. 477
4. 32

58 The hybridisation of benzyl carbonium ion



is:

1.	sp^2	2.	spd^2
3.	sp^2d	4.	sp^3

59 The pair of species that has the same bond order in the following is:
1. CO, NO^+
2. NO^-, CN^-
3. O_2, N_2
4. O_2, B_2

60 According to the law of photochemical equivalence, the energy absorbed (in ergs/mole) is given as:
(h = 6.62 × 10^{-27} ergs, c = 3 × 10^{10} cm s^{-1}, N_A = 6.02 × 10^{23} mol^{-1})

1.	$\frac{1.196\times10^8}{\lambda}$	2.	$\frac{2.859\times10^5}{\lambda}$
3.	$\frac{2.859\times10^{16}}{\lambda}$	4.	$\frac{1.196\times10^{16}}{\lambda}$

61 Three thermochemical equations are given below:

(i)	$C_{(graphite)} + O_2(g) \rightarrow CO_2(g)$; $\Delta_r H° = x$ kJ mol^{-1}
(ii)	$C_{graphite} + 1/2\ O_2(g) \rightarrow CO(g)$; $\Delta_r H° = y$ kJ mol^{-1}
(iii)	$CO(g) + 1/2\ O_2(g) \rightarrow CO_2(g)$; $\Delta_r H° = z$ kJ mol^{-1}

Based on the above equations, find out which one of the relationships given below is correct :

1.	z = x + y	2.	x = y + z
3.	y = 2z – x	4.	x = y – z

62 What is the correct order of electron gain enthalpy from least negative to most negative for the elements C, Ca, Al, F, and O?
1. Al < Ca < O < C < F
2. Al < O < C < Ca < F
3. C < F < O < Al < Ca
4. Ca < Al < C < O < F

63 The anion of acetylacetone (acac) forms $Co(acac)_3$ chelate with Co^{3+}. The rings of the chelate are:
1. Five membered
2. Four membered
3. Six membered
4. Three membered

64 At 100 °C the K_w of water is 55 times its value at 25ºC. What will be the pH of a neutral solution?
(log 55 = 1.74)

1.	7.00	2.	7.87
3.	5.13	4.	6.13

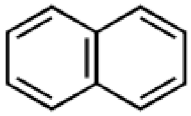
65 Identify the incorrect statements, regarding the molecule XeO_4:

1. XeO_4 molecule is square planar
2. There are four $p\pi - d\pi$ bonds
3. There are four $sp^3 - p$, σ bonds
4. XeO_4 molecule is tetrahedral

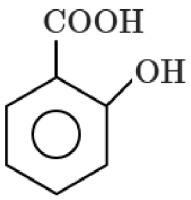
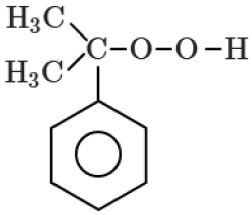
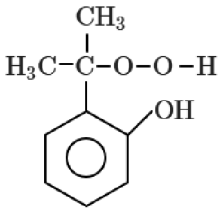
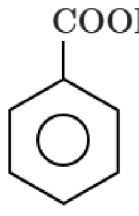
66 In Castner-Kellner cell for the production of sodium hydroxide:

1. brine is electrolyzed using graphite electrodes
2. molten sodium chloride is electrolysed
3. sodium amalgam is formed at mercury cathode
4. brine is electrolyzed with Pt electrodes

67 Which of the following chemical system is non-aromatic?

1.		2.	
3.		4.	

68 Phenol is distilled with Zn dust followed by Fridel Crafts alkylation with propyl chloride in the presence of $AlCl_3$ to give a compound (B). (B) is oxidized in the presence of air to form the compound (C). The structural formula of (C) is:

1.		2.	
3.		4.	

69 Nitrogen detection in an organic compound is carried out by Lassaigne's test. The blue colour formed corresponds to which of the following formulae:

1. $Fe_3[Fe(CN)_6]_2$
2. $Fe_4[Fe(CN)_6]_3$
3. $Fe_4[Fe(CN)_6]_2$
4. $Fe_3[Fe(CN)_6]_3$

70 $CH_3 - CH_3$, $CH_3 - CH_2 - CH_3$, $(CH_3)_2CH - CH_3$, and $CH_3 - CH_2 - CH(CH_3)_2$

The increasing order of stability of the free radicals formed from homolytic fission of the above three alkanes is:

1.	$(CH_3)_2\dot{C} - CH_2CH_3 < CH_3 - \dot{C}H - CH_3 < CH_3 - \dot{C}H_2 < (CH_3)_3\dot{C}$
2.	$CH_3 - \dot{C}H_2 < CH_3 - \dot{C}H - CH_3 < (CH_3)_2\dot{C} - CH_2CH_3 < (CH_3)_3\dot{C}$
3.	$CH_3 - \dot{C}H_2 < CH_3 - \dot{C}H - CH_3 < (CH_3)_3\dot{C} < (CH_3)_2\dot{C} - CH_2CH_3$
4.	$(CH_3)_3\dot{C} < (CH_3)_2\dot{C} - CH_2 - CH_3 < CH_3 - \dot{C}H - CH_3 < CH_3 - \dot{C}H_2$

71 Incorrect statement among the following is:

1.	Quartz is extensively used as a piezoelectric material.
2.	Silicones are a group of organosilicon polymers, which have $(-R_2SiO-)$ as a repeating unit.
3.	Basic structural unit in silicates is the SiO_4^{4-} tetrahedron.
4.	Feldspars are not aluminosilicates.

72 The outer orbitals of C in an ethene molecule can be considered to be hybridized to given three equivalent sp^2 orbitals. The total number of sigma (σ) and pi(π) bonds in ethene molecule are:

1. 3 sigma (σ) and 2 pi(π) bonds
2. 4 sigma (σ) and 1 pi(π) bonds
3. 5 sigma (σ) and 1 pi(π) bonds
4. 1 sigma (σ) and 2 pi(π) bonds

73 Which condition is not satisfied by an ideal solution?

1. $\Delta_{mix}V = 0$
2. $\Delta_{mix}S = 0$
3. Obeyance to Roult's Law
4. $\Delta_{mix}H = 0$

74 The dissociation constant of a weak acid is 1×10^{-4} in order to prepare a buffer solution with pH=5 the [salt]/ [Acid] ratio should be:

1. 4 : 5
2. 10 : 1
3. 5 : 4
4. 1 : 10

75 What is the density of N_2 gas at 227 °C and 5.00 atm pressure?
($R = 0.082$ L Atm K^{-1} mol^{-1})
1. 1.40 g/L
2. 2.81 g/L
3. 3.41 g/L
4. 0.29 g/L

76 The correct IUPAC name for $[CrF_2(en)_2]Cl$ is:

1.	Chlorodifluoridoethylenediaminechromium(III) chloride
2.	Bis-(ethylenediamine)difluoridochromium(III) chloride
3.	Difluorobis-(ethylenediamine)chromium(III) chloride
4.	Chlorodifluoridobis(ethylenediamine)chromium (III)

77 Dettol is the mixture of:
1. Chloroxylenol and Bithionol
2. Chloroxylenol and Terpineol
3. Phenol and Iodine
4. Terpineol and Bithionol

78 A reaction is 50% complete in 2 hours and 75% complete in 4 hours. The order of the reaction is:

1.	1	2.	2
3.	3	4.	0

79 The values of Ksp of $CaCO_3$ and CaC_2O_4 are 4.7×10^{-9} and 1.3×10^{-9} respectively at 25°C. If the mixture of these two is washed with water, what is the concentration of Ca^{2+} ions in the water?
1. 5.831×10^{-5} M
2. 6.856×10^{-5} M
3. 3.606×10^{-5} M
4. 7.746×10^{-5} M

80 The species/pair among the following that have sp^3 hybridization is:
1. SiF_4, BeH_2
2. NF_3,H_2O
3. NF_3,BF_3
4. H_2S, BF_3

81 In DNA, the linkages between different nitrogenous bases are:
1. Phosphate linkages
2. H-bonding
3. Glycosidic linkages
4. Peptide linkages

82 Which complex among the following exhibits a paramagnetic nature?
1. $[Co(NH_3)_6]^{3+}$
2. $[Pt(en)Cl_2]$
3. $[CoBr_4]^{2-}$
4. $Mo(CO)_6$
(At. No. Mo = 42, Pt = 78)

83 Sc(Z = 21) is a transition element but Zn (Z = 30) is not because:

1.	Both Sc^{3+} and Zn^{2+} ions are colourless and form white compounds
2.	In the case of Sc, 3d orbitals are partially filled but in Zn, these are fully filled.
3.	The last electron is assumed to be added to the 4s level in the case of Zn
4.	Both Sc and Zn do not exhibit variable oxidation states.

84 In an experiment, it showed that 10 mL of 0.05 M solution of chloride required 10 mL of 0.1 M solution of $AgNO_3$. Which of the following will be the formula of the chloride (X stands for the symbol of the element other than chlorine)?
1. X_2Cl_2
2. XCl_2
3. XCl_4
4. X_2Cl

85 A diamagnetic compound among the following is:
1. $[Co(F_6)]^{3-}$
2. $[Ni(CN)_4]^{2-}$
3. $[NiCl_4]^{2-}$
4. $[Fe(CN)_6]^{3-}$

86 A compound undergoes hydrolysis, resulting in the formation of two products. One of these products, when treated with sodium nitrite and hydrochloric acid, yields a product that does not respond to the iodoform test. The other product is capable of reducing Tollen's reagent and Fehling's solution.
Based on these observations, the compound is:
1. $CH_3CH_2CH_2NC$
2. $CH_3CH_2CH_2CN$
3. $CH_3CH_2CH_2ON = O$
4. $CH_3CH_2CH_2CON(CH_3)_2$

87 Some reactions of amines are given. Which one is not correct?

1.	$(CH_3)_2N-C_6H_4+NaNO_2+HCl \rightarrow (CH_3)_2N-C_6H_4-N=NCl$
2.	$CH_3CH_2NH_2 + HNO_2 \rightarrow CH_3CH_2OH + N_2$
3.	$CH_3NH_2 + C_6H_5SO_2Cl \rightarrow CH_3NHSO_2C_6H_5$
4.	$(CH_3)_2NH + NaNO_2 + HCl \rightarrow (CH_3)_2N-N=O$

88 In which of the following ionization processes the bond energy increases and the magnetic behaviour changes from paramagnetic to diamagnetic?

1. $O_2 \rightarrow O_2^+$
2. $C_2 \rightarrow C_2^+$
3. $NO \rightarrow NO^+$
4. $N_2 \rightarrow N_2^+$

89 In the following reaction:

$$HC \equiv CH \xrightarrow[Hg^{2+}]{H_2SO_4} P$$

Product 'P' will not give

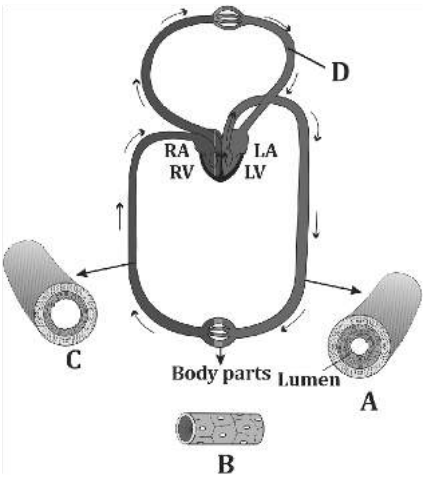
1. Tollen's reagent test
2. Fehling's solution
3. Victor Meyer test
4. Iodoform test

90 The number of isomeric alcohols (excluding stereoisomers) of molecular formula $C_6H_{14}O$ which give a positive iodoform test are:

1. Three
2. Four
3. Five
4. Two

BIOLOGY

91 Figure shows blood circulation in humans with labels A to D. Select the option which gives correct identification of label and functions of the part:



1.	B - Capillary - thin without muscle layers and well two-cell thick
2.	C - Vein - thin-walled and blood flows in jerks./spurts
3.	D - Pulmonary vein - takes oxygenated blood to heart PO_2=95 mm Hg
4.	A - Artery- thick-walled and blood flows evenly

92 Which enzymes are likely to act on the baked potatoes eaten by a man, starting from the mouth and as it moves down the alimentary canal?

1.	Pancreatic amylase → salivary amylase → lipases
2.	Disaccharidase like maltase → lipases → nucleases
3.	Salivary amylase → pancreatic amylase → disaccharidases
4.	Salivary maltase → carboxy peptidase → trypsinogen

93 The largest tiger reserve in India is:

1. Valmiki
2. Nagarjunsagar - Srisailam
3. Periyar
4. Nagarhole

94 The characteristics of class Reptilia are:

1.	Body covered with moist skin which is devoid of scales, the ear is represented by a tympanum, alimentary canal, urinary and reproductive tracts open into a common cloaca
2.	Freshwater animals with a bony endoskeleton and air bladder to regulate buoyancy
3.	Marine animals with cartilaginous endoskeletons, bodies covered with placoid scales
4.	Body covered with dry and cornified skin, scales over the body are epidermal, they do not have external ears

95 Among flowers of *Calotropis*, tulip, *Sesbania*, *Asparagus,* Colchicine, Sweet pea, *Petunia, Indigofera*, Mustard, Soybean, Tobacco and groundnut how many plants have corolla with valvate aestivation?

1.	Six	2.	Seven
3.	Eight	4.	Five

96 During muscle contraction in humans the:

1. Sarcomere does not shorten
2. A band remains the same
3. A, H and I bands shorten
4. Actin filaments shorten

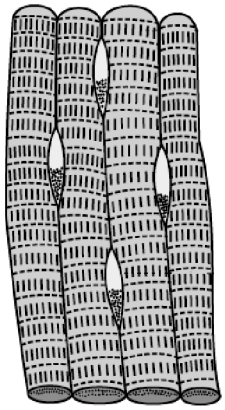
97 Which one of the following statements is correct regarding Sexually Transmitted Diseases (STD)?

1.	A person many contact syphilis by sharing milk with one already suffering from the disease
2.	Haemophilia is one of the STD
3.	Genital herpes and sickle-cell, anemia are both STD
4.	The chances of a 5-year boy contacting a STD are very little

98 During meiosis I, the chromosomes start pairing at:

1.	Zygotene	2.	Pachytene
3.	Diplotene	4.	Leptotene

99 Identify the tissue shown in the diagram and match with its characteristics and its location:



1.	Smooth muscles, show branching, found in the walls of the heart
2.	Cardiac muscles, unbranched muscles, found in the walls of the heart
3.	Striated muscles, tapering at both ends attached to the bones of the ribs
4.	Skeletal muscle, shows striations and is closely attached to the bones of the limbs

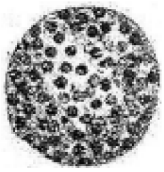
100 One of the most frequently used techniques in DNA fingerprinting is:

1. VNTR
2. SSCP
3. SCAR
4. AFLP

101 The common characteristics between tomato and potato will be maximum at the level of their:

1. Family
2. Order
3. Division
4. Genus

102 The figure shows a human blood cell. Identify it and give its characteristics:



	Blood cell	Characteristics
1.	Basophils	Secrete serotonin
2.	B-lymphocytes	form about 20% of blood cells involved in immune response
3.	Neutrophils	Most abundant blood cells, phagocytic
4.	Monocytes	Life spans 3 days, produce antibodies

103 Random unidirectional change in allele frequencies that occur by chance in all populations and especially in small populations is known as:-
1. Migration
2. Natural selection
3. Genetic drift
4. Mutation

104 The plant body is thalloid in:

1.	*Sphagnum*	2.	*Salvinia*
3.	*Marchantia*	4.	*Funaria*

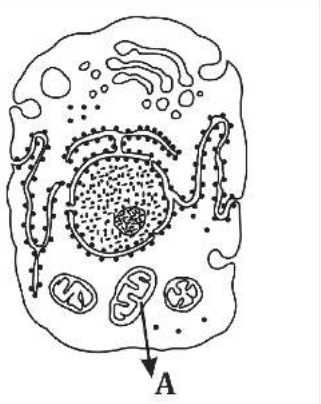
105 Select the correct option with respect to Cockroaches:

1.	Malpighian tubules convert nitrogenous wastes into urea
2.	Males bear short and styles not present in females
3.	Nervous system comprises a dorsal nerve cord and ten pairs of ganglion
4.	The fore wings are tegmina which are used in flight

106 During the metaphase stage of mitosis spindle fibres attach to chromosomes at:

1.	kinetochore
2.	both centromere and kinetochore
3.	centromere, kinetochore and areas adjoining centromere
4.	centromere

107 Select the alternative giving correct identification and function of the organelle 'A' in the diagram:



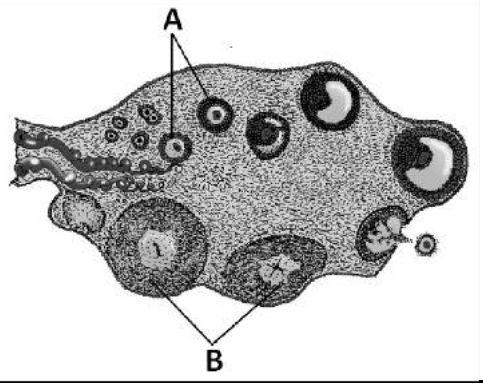
1.	Mitochondria - produce cellular energy in the form of ATP
2.	Golgi body - provides packaging material
3.	Lysosomes - secrete hydrolytic enzymes
4.	Endoplasmic reticulum - synthesis of lipids

108 RNA interference involves:

1.	Synthesis of cDNA from RNA using reverse transcriptase
2.	Silencing of specific mRNA due to complementary RNA
3.	Interference of RNA in the synthesis of DNA
4.	Synthesis of mRNA from DNA

109 Which one of the following groups of animals reproduces only by sexual means?
1. Cnidaria
2. Porifera
3. Protozoa
4. Ctenophora

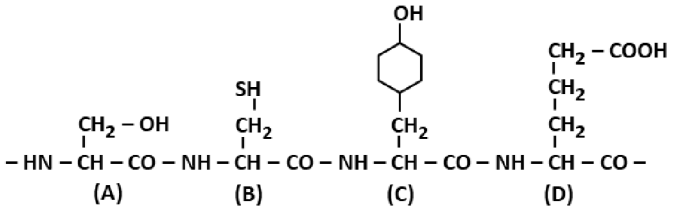
110 The figure shows a section of the human ovary. Select the option which gives the correct identification of A and B with function/characteristic:



1.	B - Corpus luteum - secretes progesterone
2.	A - Tertiary follicle - forms Graafian follicle
3.	B - Corpus luteum - secretes LH
4.	A - Primary oocyte - it is the prophase - I of the meiotic division

111 The stage transferred into the uterus after induced fertilization of ova in the laboratory is:
1. embryo at 4 blastomere stage
2. embryo at 2 blastomere stage
3. Morula
4. Zygote

112 The figure shows a hypothetical tetrapeptide portion of a protein with parts labelled A-D. Which one of the following options is correct?



1.	D is the acidic amino acid - glutamic acid
2.	C is an aromatic amino acid - tryptophan
3.	A is the C-terminal amino acid and D is N terminal amino acid
4.	A is the sulphur containing amino acid-methionine

113 Identify the site where Wuchereria bancrofti is normally found on human body.
1. Muscles of the legs
2. Blood vessels of the thigh region
3. Skin between the fingers
4. Lymphatic vessels of the lower limbs

114 In our society women are blamed for producing female children. Choose the correct answer for sex-determination in humans.

1.	due to some defect like aspermia in man
2.	due to the genetic makeup of the particular sperm which fertilizes the egg
3.	due to the genetic makeup of the egg
4.	due to some defect in the women

115 Genetic variation in a population arises due to:
1. Recombination only
2. Mutations as well as recombination
3. Reproductive isolation and selection
4. Mutations only

116 The second commitment period for Kyoto Protocol was decided at:
1. Durban
2. Bali
3. Doha
4. Cancun

117 Climate of the world is threatened by:
1. Decreasing amount of atmospheric oxygen
2. Increasing amount of atmospheric carbon dioxide
3. Decreasing amount of atmospheric carbon dioxide
4. Increasing concentration of atmospheric oxygen

118 Which of the following statement is not true for stomatal apparatus?

1.	Guard cells invariably possess chloroplasts and mitochondria
2.	Guard cells are always surrounded by subsidiary cells
3.	Stomata are involved in gaseous exchange
4.	Inner walls of guard cells are thick

119 The age pyramid with broad base indicates:
1. high percentage of old individuals
2. low percentage of young individuals
3. a stable population
4. high percentage of young individuals

120 Select the option which shows the correct matching of animal with excretory organs and excretory product:

	Animal	Excretory organs	Excretory product
1.	*Labeo* (Rohu)	Nephridial tubes	Ammonia
2.	Salamander	Kidney	Urea
3.	Peacock	Kidney	Urea
4.	Housefly	Renal tubules	Uric acid

121 Which of the following best illustrates FEEDBACK in development?

1.	Tissue (X) secretes RNA which changes the development of tissue (Y)
2.	As tissue (X) develops, it secretes enzymes that inhibit the development of tissue (Y)
3.	As tissue (X) develops, it secretes something that induces tissue (Y) to develop
4.	As tissues (X) develops, it secretes something that shows down the growth of tissue (Y)

122 Which of the following type of plastids does not contain stored food material?
1. Chromoplasts
2. Eleioplasts
3. Aleuroplasts
4. Amyloplasts

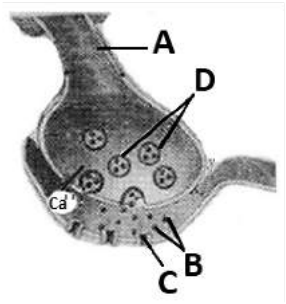
123 Tissue culture technique can produce an infinite number of new plants from a small parental tissue. The economic importance of the technique is in raising:

1.	genetically uniform population identical to the original parent
2.	homozygous diploid plants
3.	development of new species
4.	variants through picking up somaclonal variations

124 Inflorescence is racemose in:
1. Brinjal
2. Tulip
3. Aloe
4. Soybean

125 Which one of the following is wrongly matched?
1. *Spirogyra* -Motile gametes
2. *Sargassum* - Chlorophyll C
3. Basidiomycetes - Puffballs
4. *Nostoc*- Water blooms

126 The figure shows an axon terminal and synapse. Select the option giving correct identifications of labels A-D.



1. A-Action potential C-Neurotransmitter
2. B-Neurotransmitter D-Receptor capsules
3. C-Receptor D-Synaptic vesicles
4. A-Axon terminal B-Serotonin complex

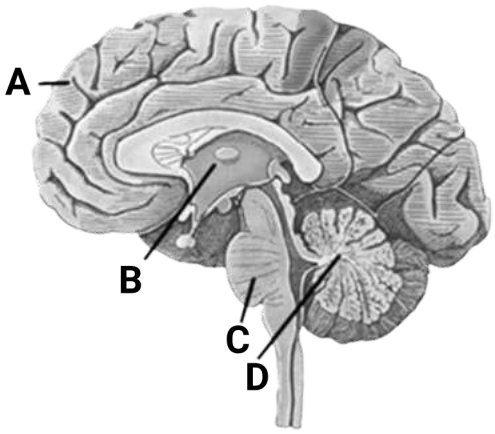
127 Which one of the following vectors is used to replace the defective gene in gene therapy?
1. Adenovirus
2. Cosmid
3. Ri plasmid
4. Ti plasmid

128 Animal vectors are required for pollination in:
1. Vallisneria
2. Mulberry
3. Cucumber
4. Maize

129 Which one of the following is not a parasitic adaptation?
1. Development of adhesive organs
2. Loss of digestive organs
3. Loss of reproductive capacity
4. Loss of unnecessary sense organs

130 The pineapple which under natural conditions is difficult to blossom has been made to produce fruits throughout the year by application of:
1. NAA, 2, 4-D
2. GA_3
3. Cytokinin
4. IAA, IBA

131 A sagittal section of the human brain is shown here. Identify at least two labels from A-D:



1. C-Mid brain D-Cerebellum
2. A-Cerebrum C-Pons
3. B-Corpus callosum D-Medulla
4. A-Cerebral hemispheres B-Cerebellum

132 Microbe used for biocontrol of pest butterfly caterpillars is:
1. Saccharomyces cerevisiae
2. Bacillus thuringiensis
3. Streptococcus sp.
4. Trichoderma sp.

133 Down's syndrome in humans is due to:
1. Three 'X' chromosomes
2. Three copies of chromosome 21
3. Monosomy
4. Two 'Y' chromosomes

134 The viability of seeds is tested by:
1. 2, 6 dichlorophenol indophenols
2. 2, 3, 5 triphenyl tetrazolium chloride
3. DMSO
4. Safranine

135 What is common in all the three, *Funaria*, *Dryopteris* and Ginkgo?
1. Presence of archegonia
2. Well-developed vascular tissues
3. Independent gametophyte
4. Independent sporophyte

136 Albuminous seeds store their reserve food mainly in:
1. Endosperm
2. Cotyledons
3. Hypocotyl
4. Perisperm

137 Megaspores are produced from the megaspore mother cells after:
1. Mitotic division
2. Formation of a thick wall
3. Differentiation
4. Meiotic division

138 Benthic organisms are affected most by:
1. Light reaching the forest floor
2. Surface turbulence of water
3. Sediment characteristics of aquatic ecosystems
4. Water-holding capacity of soil

139 Bundle sheath cells:

1.	are rich in PEP carboxylase
2.	lack RuBisCo
3.	lack both RuBisCo and PEP carboxylase
4.	are rich in RuBisCo

140 Meristematic tissue responsible for the increase in girth of a tree trunk is:
1. Intercalary meristem
2. Lateral meristem
3. Phellogen
4. Apical meristem

141 Which one of the following animals is correctly matched with its one characteristic and the taxon?

	Animal	Characteristic	Taxon
1.	Millipede	Ventral nerve cord	Arachnids
2.	Sea Anemone	Triploblastic	Cnidaria
3.	Silverfish	Pectoral and pelvic fins	Chordata
4.	Duckbilled platypus	Oviparous	Mammalian

142 Which one of the following is not correct as regards the harmful effects of particulate matter of the size 2.5 micrometers or less?
1. It can cause respiratory problems
2. It can directly enter into our circulatory system
3. It can cause inflammation and damage to the lungs
4. It can be inhaled into the lungs

143 Which of the following has maximum genetic diversity in India?
1. Mango
2. Wheat
3. Groundnut
4. Rice

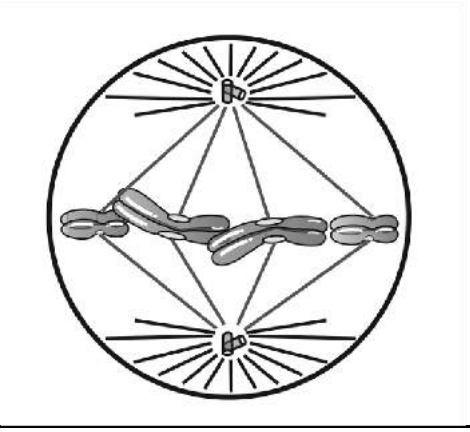
144 Which one is the incorrect statement with regards to the importance of pedigree analysis?

1.	It confirms that DNA is the carrier of genetic information
2.	It helps to understand whether the trait in question is dominant or recessive
3.	It confirms that the trait is linked to one of the autosomes
4.	It helps to trace the inheritance of a specific trait

145 Specialized cells for fixing atmospheric nitrogen in *Nostoc* are:
1. Heterocysts
2. Hormogonia
3. Nodules
4. Akinetes

146 One of the following is not a method of contraception-which one?
1. condoms
2. pills of a combination of oxytocin and vasopressin
3. Lippes loop
4. tubectomy

147 A stage of mitosis is shown in the diagram. Which stage is it and what are its characteristics?



1.	Metaphase-spindle fibers attached to kinetochores, centromeres split and chromatids separate
2.	Metaphase- chromosomes moved to spindle equator, chromosomes made up of two sister chromatids
3.	Anaphase - centromeres split and chromatids separate and start moving away
4.	Late prophase - chromosomes move to spindle equator

148 In a cymose inflorescence, the main axis:

1.	has unlimited growth
2.	bears a solitary flower
3.	has unlimited growth but lateral branches end in flowers
4.	terminates in a flower

149 Sharks and dogfishes differ from skates and rays by:

1.	Gill slits are ventrally placed
2.	Head and trunk are widened considerably
3.	Distinct demarcation between body and tail
4.	Their pectorals fins are distinctly marked off from cylindrical bodies

150 The term 'glycocalyx' is used for:

1.	a layer present between cell wall and membrane of bacteria
2.	cell wall of bacteria
3.	bacterial cell glyco-engineered to possess N-glycosylated proteins
4.	a layer surrounding the cell wall of bacteria

151 In an inducible operon, the genes are:

1. usually not expressed unless a signal turns them "on"
2. usually expressed unless a signal turns them "off"
3. never expressed
4. always expressed

152 Select the option which correctly matches the endocrine gland with its hormone and its function:

	Endocrine gland	**Hormone**	**Functions**
1.	Placenta	estrogen	initiates secretion of milk
2.	Corpus luteum	estrogen	essential for the maintenance of endometrium
3.	Leydig cells	androgen	initiates the production of sperm
4.	Ovary	FSH	stimulates follicular development and the secretion of estrogens

153 Genes of interest can be selected from a genomic library by using:

1. Cloning vectors
2. DNA probes
3. Gene targets
4. Restriction enzymes

154 A healthy person eats the following diet-5gm raw sugar, 4 gm albumin, 10 gm pure buffalo ghee adulterated with 2 gm vegetable ghee (hydrogenated vegetable oil) and 5 gm lignin. How many calories he is likely to get?

1. 126
2. 164
3. 112
4. 144

155 Select the correct statement with respect to disorders of muscles in humans.

1.	Failure of neuromuscular transmission in myasthenia gravis can prevent normal swallowing
2.	Accumulation of urea and creatine in the joints causes their inflammation
3.	An overdose of vitamin D causes osteoporosis
4.	Rapid contractions of skeletal muscles causes muscle dystrophy

156 How many plants among China rose, *Ocimum*, sunflower, mustard, *Alstonia,* guava, *Calotropis* and *Nerium* (Oleander) have opposite phyllotaxy?

1. Three
2. Four
3. Five
4. Two

157 Which of the following statements is not true about somatic embryogenesis?

1.	The pattern of development of a somatic embryo is comparable to that of a zygotic embryo
2.	Somatic embryos can develop from microspores
3.	Somatic embryo is induced usually by an auxin such as 2, 4–D
4.	A somatic embryo develops from a somatic cell

158 Which one of the following statements is correct?

1.	Cleistogamous flowers are always autogamous
2.	Xenogamy occurs only by wind pollination
3.	Chasmogamous flowers do not open at all
4.	Geitonogamy involves the pollen and stigma of flowers of different plants

159 Norepinephrine:

a. is released by sympathetic fibers
b. is released by parasympathetic fibers
c. increases the heart rate
d. decreases blood pressure
Which of the above said statements are correct?

1.	**a** and **c**	2.	**b** and **c**
3.	**b** and **d**	4.	**a** and **d**

160 Dinosaurs dominated the World in which of the following geological era?
1. Coenozoic
2. Jurassic
3. Mesozoic
4. Devonion

161 Which of the following statements is correct?

1.	Sporopollenin can be degraded by enzymes
2.	Sporopollenin in made up of inorganic materials
3.	Sporopollenin can withstand high temperatures as well as strong acids and alkalis
4.	Sporopollenin can withstand high temperatures but not strong acids

162 Which one of the following is a hallucinogenic drug?
1. Caffeine
2. Morphine
3. Lysergic acid diethylamide
4. Opium

163 The finch species of Galapagos Islands are grouped according to their food sources. Which of the following is not a finch food?
1. Carrion
2. Insects
3. Tree buds
4. Seeds

164 Which of the following is not a property of the genetic code?
1. Non-overlapping
2. Ambiguous
3. Degeneracy
4. Universal

165 Which of the following elements is a constituent of biotin?
1. Magnesium
2. Calcium
3. Phosphorus
4. Sulphur

166 Satellite RNA are present in some:
1. Viroids
2. Prions
3. Bacteriophages
4. Plant viruses

167 Which two distinct microbial processes are responsible for the release of fixed nitrogen as dinitrogen gas (N_2) to the atmosphere?

1.	Aerobic nitrate oxidation, and nitrite reduction
2.	Decomposition of organic nitrogen, and conversion of dinitrogen to ammonium compounds
3.	Enteric fermentation in cattle, and nitrogen fixation by *Rhizobium* in root nodules of legumes
4.	Anaerobic ammonium oxidation, and denitrification

168 Which of the following represents the action of insulin?

1.	Increases blood glucose levels by stimulating glucagon production
2.	Decreases blood glucose levels by forming glycogen
3.	Increases blood glucose level by promoting cellular uptake of glucose
4.	Increases blood glucose levels by hydrolysis of glycogen

169 Which one of the following is true for fungi?
1. They lack a rigid cell wall
2. They are heterotrophs
3. They lack nuclear membrane
4. They are phagotrophs

170 Why is a capsule advantageous to a bacterium?

1.	It protects the bacterium from desiccation
2.	It provides means of locomotion
3.	It allows the bacterium to "hide" from the host's immune system.
4.	It allows the bacterium to attach to the surface

171 The foetal ejection reflex in humans triggers the release of:
1. oxytocin from foetal pituitary
2. human Chorionic Gonadotropin (hCG) from placenta
3. human Placental Lactogen (hPL) from placenta
4. oxytocin from maternal pituitary

172 Which one of the following is a primary consumer in maize field ecosystem?

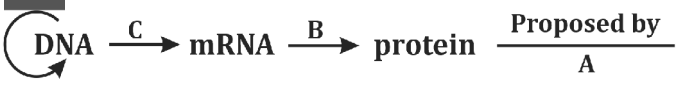
1.	Grasshopper	2.	Wolf
3.	Phytoplankton	4.	Lion

173 During the process of isolation of DNA, chilled ethanol is added to:
1. Precipitate DNA
2. Break open the cell to release DNA
3. Facilitate action of restriction enzymes
4. Remove proteins such as histones

174 When a man eats fish which feeds on zooplankton which has eaten small plants, the producer in the chain is:
1. Small plants
2. Fish
3. Man
4. Zooplankton

175 Syngamy can occur outside the body of the organism in:
1. Mosses
2. Algae
3. Ferns
4. Fungi

176



The figure gives an important concept in the genetic implication of DNA. Fill in the blanks A, B and C.
1. A - Maurice Wilkins B - transcription C - translation
2. A - James Watson B - replication C - extension
3. A - Erwin Chargaff B - translation C - replication
4. A - Francis Crick B - translation C - transcription

177 Uridine, present only in RNA is:
1. nucleoside
2. nucleotide
3. purine
4. pyrimidine

178 Which one of the following is one of the paths followed by air/O2 during respiration in an adult male Periplaneta americana as it enters the animal body?

1.	Spiracle in metathorax, trachea, tracheoles, oxygen diffuses into cells
2.	Mouth, bronchial tube, trachea, oxygen enters cells
3.	Spiracles in prothorax, tracheoles, and trachea oxygen diffuses into cells
4.	Hypopharynx, mouth, pharynx, trachea, tissues

179 Which of the following statements about enzymes is wrong?

1.	Enzymes are denatured at high temperatures
2.	Enzymes are mostly proteins but some are lipids also
3.	Enzymes are highly specific.
4.	Enzymes require optimum pH and temperature for maximum activity.

180 Which organization publishes the 'Red Data Book'?

1.	IUCN	2.	UNEP
3.	WWF	4.	GEF