SOLVED PAPER
AIIMS - 2005

Time : 3½ Hours | Max. Marks : 200

PHYSICS

1. For skywave propagation of a 10 MHz signal, what should be the minimum electron density in ionosphere?
(a) $\sim 1.2 \times 10^{12}$ m^{-3} (b) $\sim 10^{6}$ m^{-3}
(c) $\sim 10^{14}$ m^{-3} (d) $\sim 10^{22}$ m^{-3}.

2. Which of the following logic gates is an universal gate?
(a) OR (b) NOT
(c) AND (d) NAND.

3. What should be the maximum acceptance angle at the air-core interface of an optical fibre if n_1 and n_2 are the refractive indices of the core and the cladding, respectively?
(a) $\sin^{-1}(n_2/n_1)$ (b) $\sin^{-1}\sqrt{n_1^2 - n_2^2}$
(c) $\left[\tan^{-1}\frac{n_2}{n_1}\right]$ (d) $\left[\tan^{-1}\frac{n_1}{n_2}\right]$

4. A conducting ring of radius 1 meter is placed in an uniform magnetic field B of 0.01 tesla oscillating with frequency 100 Hz with its plane at right angle to B. What will be the induced electric field?
(a) π volts/m (b) 2 volts/m
(c) 10 volts/m (d) 62 volts/m.

5. Consider an n-p-n transistor amplifier in common-emitter configuration. The current gain of the transistor is 100. If the collector current changes by 1 mA, what will be the change in emitter current?
(a) 1.1 mA (b) 1.01 mA
(c) 0.01 mA (d) 10 mA.

6. A telescope has an objective lens of focal length 200 cm and an eye piece with focal length 2 cm. If this telescope is used to see a 50 meter tall building at a distance of 2 km, what is the height of the image of the building formed by the objective lens?
(a) 5 cm (b) 10 cm
(c) 1 cm (d) 2 cm.

7. The ground state energy of hydrogen atom is –13.6 eV. What is the potential energy of the electron in this state?
(a) 0 eV (b) –27.2 eV
(c) 1 eV (d) 2 eV.

8. Solid targets of different elements are bombarded by highly energetic electron beams. The frequency (f) of the characteristic X-rays emitted from different targets varies with atomic number Z as
(a) $f \propto \sqrt{Z}$ (b) $f \propto Z^2$
(c) $f \propto Z$ (d) $f \propto Z^{3/2}$.

9. Two infinitely long parallel conducting plates having surface charge densities $+\sigma$ and $-\sigma$ respectively, are separated by a small distance. The medium between the plates is vacuum. If ε_0 is the dielectric permittivity of vacuum, then the electric field in the region between the plates is
(a) 0 volt/meter (b) $\sigma/2\varepsilon_0$ volt/meter
(c) σ/ε_0 volt/meter (d) $2\sigma/\varepsilon_0$ volt/meter.

10. In a semiconducting material the mobilities of electrons and holes are μ_e and μ_n respectively. Which of the following is true?
(a) $\mu_e > \mu_n$ (b) $\mu_e < \mu_n$
(c) $\mu_e = \mu_n$ (d) $\mu_e < 0$; $\mu_n > 0$.

11. The magnetic moment (μ) of a revolving electron around the nucleus varies with principal quantum number n as
(a) $\mu \propto n$ (b) $\mu \propto 1/n$
(c) $\mu \propto n^2$ (d) $\mu \propto 1/n^2$.

12. A radioactive material has a half-life of 10 days. What fraction of the material would remain after 30 days?
(a) 0.5 (b) 0.25
(c) 0.125 (d) 0.33

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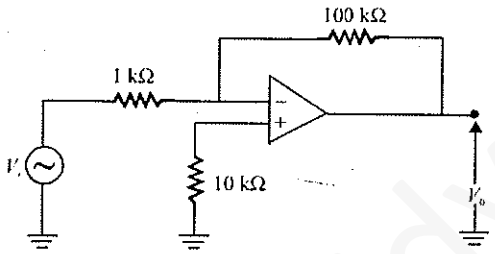
13. According to Hubble's law, the redshift ($\not{Z}$) of a receding galaxy and its distance r from earth are related as
(a) $\not{Z} \propto r$ (b) $\not{Z} \propto 1/r$
(c) $\not{Z} \propto 1/r^2$ (d) $\not{Z} \propto r^{3/2}$.

14. When exposed to sunlight, thin films of oil on water often exhibit brilliant colours due to the phenomenon of
(a) interference (b) diffraction
(c) dispersion (d) polarisation.

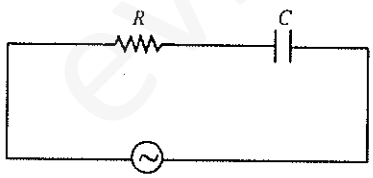
15. "Parsec" is the unit of
(a) time (b) distance
(c) frequency (d) angular acceleration.

16. The voltage gain of the following amplifier is



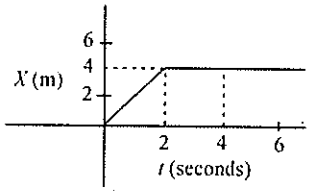
(a) 10 (b) 100
(c) 1000 (d) 9.9

17. A 50 Hz a.c. source of 20 volts is connected across R and C as shown in figure. The voltage across R is 12 volt. The voltage across C is



(a) 8 V (b) 16 V
(c) 10 V
(d) not possible to determine unless values of R and C are given.

18. In the figure given, the position-time graph of a particle of mass 0.1 kg is shown. The impulse at $t = 2$ sec is



(a) 0.2 kg m sec^{-1} (b) – 0.2 kg m sec^{-1}
(c) 0.1 kg m sec^{-1} (d) – 0.4 kg m sec^{-1}.

19. The pressure exerted by an electromagnetic wave of intensity I (watt/m^2) on a nonreflecting surface is [c is the velocity of light]
(a) Ic (b) Ic^2
(c) I/c (d) I/c^2.

20. A block of mass 10 kg is moving in x-direction with a constant speed of 10 m/sec. It is subjected to a retarding force $F = -0.1x$ joule/meter during its travel from $x = 20$ meter to $x = 30$ meter. Its final kinetic energy will be
(a) 475 joule (b) 450 joule
(c) 275 joule (d) 250 joule.

21. Energy required to break one bond in DNA is approximately
(a) ~ 1 eV (b) ~ 0.1 eV
(c) ~ 0.01 eV (d) ~ 2.1 eV.

22. The condition for a uniform spherical mass m of radius r to be a black hole is [G = gravitational constant and g = acceleration due to gravity]
(a) $\left(\frac{2Gm}{r}\right)^{1/2} \leq c$ (b) $\left(\frac{2gm}{r}\right)^{1/2} = c$
(c) $\left(\frac{2Gm}{r}\right)^{1/2} \geq c$ (d) $\left(\frac{gm}{r}\right)^{1/2} \geq c$

23. Which of the following is an amorphous solid?
(a) glass (b) diamond
(c) salt (d) sugar.

24. For a constant hydraulic stress on an object, the fractional change in the object's volume ($\Delta V/V$) and its bulk modulus (B) are related as
(a) $\frac{\Delta V}{V} \propto B$ (b) $\frac{\Delta V}{V} \propto \frac{1}{B}$
(c) $\frac{\Delta V}{V} \propto B^2$ (d) $\frac{\Delta V}{V} \propto B^{-2}$

25. Which of the following functions represents a simple harmonic oscillation?
(a) $\sin\omega t - \cos\omega t$ (b) $\sin^2\omega t$
(c) $\sin\omega t + \sin 2\omega t$ (d) $\sin\omega t - \sin 2\omega t$.

26. In case of linearly polarised light, the magnitude of the electric field vector
(a) does not change with time
(b) varies periodically with time
(c) increases and decreases linearly with time
(d) is parallel to the direction of propagation.

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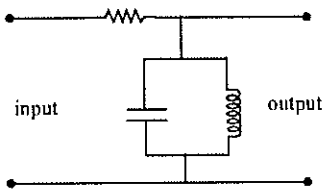
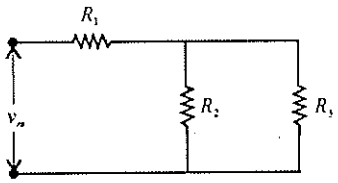
27. The circuit shown below acts as



(a) tuned filter
(b) low pass filter
(c) high pass filter (d) rectifier.

28. For ensuring dissipation of same energy in all three resistors (R_1, R_2, R_3) connected as shown in figure, their values must be related as

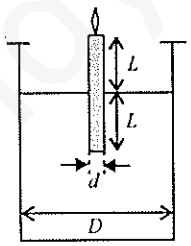


(a) $R_1 = R_2 = R_3$ (b) $R_2 = R_3$ and $R_1 = 4R_2$
(c) $R_2 = R_3$ and $R_1 = 1/4R_2$
(d) $R_1 = R_2 + R_3$.

29. The apparent depth of water in cylindrical water tank of diameter $2R$ cm is reducing at the rate of x cm/minute when water is being drained out at a constant rate. The amount of water drained in c.c. per minute is (n_1 = refractive index of air, n_2 = refractive index of water).

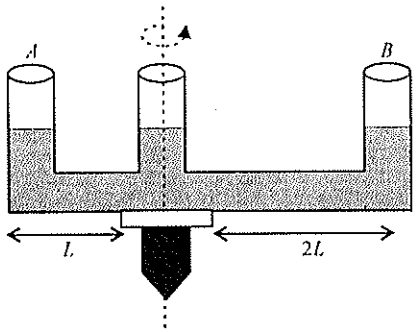
(a) $\frac{x\pi R^2 n_1}{n_2}$ (b) $\frac{x\pi R^2 n_2}{n_1}$
(c) $\frac{2\pi R n_1}{n_2}$ (d) $\pi R^2 x$.

30. A candle of diameter d is floating on a liquid in a cylindrical container of diameter D ($D >> d$) as shown in figure. If it is burning at the rate of 2 cm/hour then the top of the candle will



(a) remain at the same height
(b) fall at the rate of 1 cm/hour
(c) fall at the rate of 2 cm/hour
(d) go up at the rate of 1 cm/hour.

31. A given shaped glass tube having uniform cross section is filled with water and is mounted on a rotatable shaft as shown in figure. If the tube is rotated with a constant angular velocity ω when

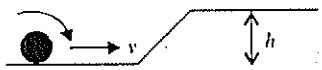


(a) water levels in both sections A and B go up
(b) water level in section A goes up and that in B comes down
(c) water level in section A comes down and that in B it goes up
(d) water levels remain same in both sections.

32. When a ball is thrown up vertically with velocity v_0, it reaches a maximum height of h. If one wishes to triple the maximum height then the ball should be thrown with velocity

(a) $\sqrt{3}v_0$ (b) $3v_0$
(c) $9v_0$ (d) $3/2\ v_0$.

33. A solid sphere is rolling on a frictionless surface, shown in figure with a translational velocity v m/s. If it is to climb the inclined surface then v should be



(a) $\geq \sqrt{10/7gh}$ (b) $\geq \sqrt{2gh}$
(c) $2gh$ (d) $10/7gh$.

34. A horizontal platform is rotating with uniform angular velocity around the vertical axis passing through its centre. At some instant of time a viscous fluid of mass m is dropped at the centre and is allowed to spread out and finally fall. The angular velocity during this period
(a) decreases continuously
(b) decreases initially and increases again
(c) remains unaltered
(d) increases continuously.

35. A ladder is leaned against a smooth wall and it is allowed to slip on a frictionless floor. Which figure represents trace of its centre of mass.

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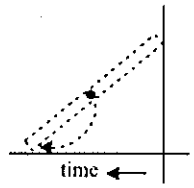
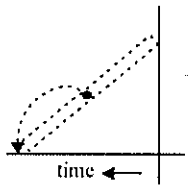
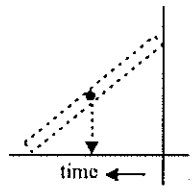
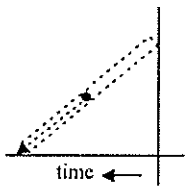
(a) 

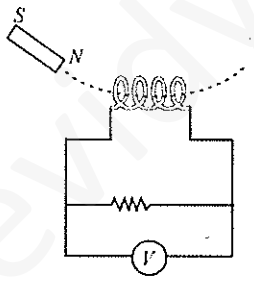
(b) 

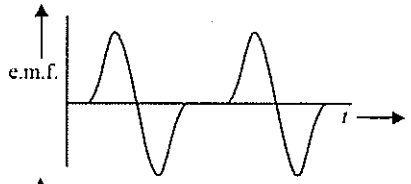
(c) 

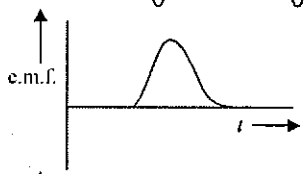
(d) 

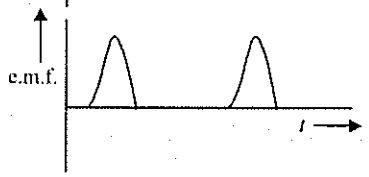
36. A person is standing in an elevator. In which situation he finds his weight less?
(a) when the elevator moves upward with constant acceleration.
(b) when the elevator moves downward with constant acceleration.
(c) when the elevator moves upward with uniform velocity
(d) when the elevator moves downward with uniform velocity.

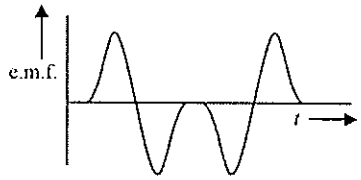
37. A magnet is made to oscillate with a particular frequency, passing through a coil as shown in figure. The time variation of the magnitude of e.m.f. generated across the coil during one cycle is



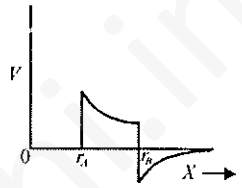
(a) 

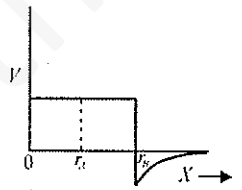
(b) 

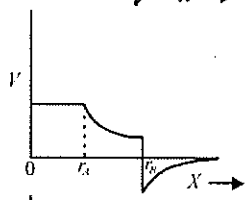
(c) 

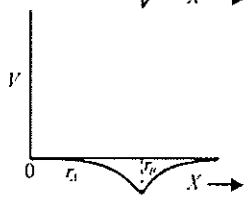
(d) 

38. Two concentric conducting thin spherical shells A and B having radii r_A and r_B ($r_B > r_A$) are charged to Q_A and $-Q_B$ ($|Q_B| > |Q_A|$). The electrical field along a line, (passing through the centre is)

(a) 

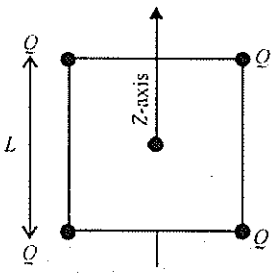
(b) 

(c) 

(d) 

39. Dimension of electrical resistance is
(a) $ML^2T^{-3}A^{-1}$ (b) $ML^2T^{-3}A^{-2}$
(c) $ML^3T^{-3}A^{-2}$ (d) $ML^{-1}L^3T^3A^2$.

40. Four point +ve charges of same magnitude (Q) are placed at four corners of a rigid square frame as shown in figure. The plane of the frame is perpendicular to Z-axis. If a –ve point



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charge is placed at a distance z away from the above frame ($z << L$) then
(a) –ve charge oscillates along the Z-axis
(b) it moves away from the frame
(c) it moves slowly towards the frame and stays in the plane of the frame
(d) it passes through the frame only once.

Directions for questions 41-60 : *In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as*
(a) If both assertion and reason are true and reason is the correct explanation of assertion
(b) If both assertion and reason are true but reason is not the correct explanation of assertion
(c) If assertion is true but reason is false
(d) If both assertion and reason are false.

41. Assertion : Specific gravity of a fluid is a dimensionless quantity.
Reason : It is the ratio of density of fluid to the density of water.

42. Assertion : Frictional forces are conservative forces.
Reason : Potential energy can be associated with frictional forces.

43. Assertion : By roughening the surface of a glass sheet its transparency can be reduced.
Reason : Glass sheet with rough surface absorbs more light.

44. Assertion : A diode lasers are used as optical sources in optical communication.
Reason : Diode lasers consume less energy.

45. Assertion : Diamond glitters brilliantly.
Reason : Diamond does not absorb sunlight.

46. Assertion : The energy (E) and momentum (p) of a photon are related by $p = E/c$.
Reason : The photon behaves like a particle.

47. Assertion : The clouds in sky generally appear to be whitish.
Reason : Diffraction due to clouds is efficient in equal measure at all wavelengths.

48. Assertion : Television signals are received through sky-wave propagation.
Reason : The ionosphere reflects electromagnetic waves of frequencies greater than a certain critical frequency.

49. Assertion : The logic gate NOT can be built using diode.
Reason : The output voltage and the input voltage of the diode have 180° phase difference.

50. Assertion : The resolving power of a telescope is more if the diameter of the objective lens is more.
Reason : Objective lens of large diameter collects more light.

51. Assertion : Reversible systems are difficult to find in real world.
Reason : Most processes are dissipative in nature.

52. Assertion : For a system of particles under central force field, the total angular momentum is conserved.
Reason : The torque acting on such a system is zero.

53. Assertion : Air quickly leaking out of a balloon becomes cooler.
Reason : The leaking air undergoes adiabatic expansion.

54. Assertion : It is not possible to use ^{35}Cl as the fuel for fusion energy.
Reason : The binding energy of ^{35}Cl is too small.

55. Assertion : The number of electrons in a p-type silicon semiconductor is less than the number of electrons in a pure silicon semiconductor at room temperature.
Reason : It is due to law of mass action.

56. Assertion : In a common emitter transistor amplifier the input current is much less than the output current.
Reason : The common emitter transistor amplifier has very high input impedance.

57. Assertion : A body that is a good radiator is also a good absorber of radiation at a given wavelength.
Reason : According to Kirchoff's law the absorptivity of a body is equal to its emissivity at a given wavelength.

58. Assertion : In pressure-temperature (P-T) phase diagram of water, the slope of the melting curve is found to be negative.
Reason : Ice contracts on melting to water.

59. Assertion : For higher temperatures the peak emission wavelength of a black body shifts to lower wavelengths.
Reason : Peak emission wavelengths of a blackbody is proportional to the fourth-power of temperature.

60. Assertion : For Reynold number $R_e > 2000$, the flow of fluid is turbulent.
Reason : Inertial forces are dominant compared to the viscous forces at such high Reynold numbers.

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CHEMISTRY

61. Among the following molecules

(i) $\ddot{X}eO_3$ (ii) $\ddot{X}eOF_4$ (iii) $\ddot{X}eF_6$

Those having same number of lone pairs on Xe are

(a) (i) and (ii) only
(b) (i) and (iii) only
(c) (ii) and (iii) only
(d) (i), (ii) and (iii).

62. An aqueous solution of $CoCl_2$ on addition of excess of concentrated HCl turns blue due to formation of

(a) $[Co(H_2O)_4Cl_2]$ (b) $[Co(H_2O)_2Cl_4]^{2-}$
(c) $[CoCl_4]^{2-}$ (d) $[Co(H_2O)_2Cl_2]$

63. In which of the following pairs both the complex's show optical isomerism?

(a) *cis*-$[Cr(C_2O_4)_2Cl_2]^{3-}$, *cis*-$[Co(NH_3)_4Cl_2]$
(b) $[Co(en)_3]Cl_3$, *cis*-$[Co(en)_2Cl_2]Cl$
(c) $[PtCl(dien)]Cl$, $[NiCl_2Br_2]^{2-}$
(d) $[Co(NO_3)_3(NH_3)_3]$, *cis*-$[Pt(en)_2Cl_2]$.

64. The diamagnetic species is

(a) $[Ni(CN)_4]^{2-}$ (b) $[NiCl_4]^{2-}$
(c) $[CoCl_4]^{2-}$ (d) $[CoF_6]^{2-}$.

65. In the balanced chemical reaction

$$IO_3^- + aI^- + bH^+ \rightarrow cH_2O + d\,I_2$$

a, *b*, *c* and *d* respectively corresponds to

(a) 5, 6, 3, 3 (b) 5, 3, 6, 3
(c) 3, 5, 3, 6 (d) 5, 6, 5, 5

66. Among the following pairs of ions, the lower oxidation state in aqueous solution is more stable than the other, in

(a) Tl^+, Tl^{3+} (b) Cu^+, Cu^{2+}
(c) Cr^{2+}, Cr^{3+} (d) V^{2+}, VO^{2+}.

67. The number of P – O – P bridges in the structure of phosphorus pentoxide and phosphorus trioxide are respectively

(a) 6, 6 (b) 5, 5
(c) 5, 6 (d) 6, 5.

68. In diborane, the two H – B – H angles are nearly

(a) 60°, 120° (b) 95°, 120°
(c) 95°, 150° (d) 120°, 180°.

69. Which of the following gives propyne on hydrolysis?

(a) Al_4C_3 (b) Mg_2C_3
(c) B_4C (d) La_4C_3.

70. The pair of amphoteric hydroxides is

(a) $Al(OH)_3$, LiOH
(b) $Be(OH)_2$, $Mg(OH)_2$
(c) $B(OH)_3$, $Be(OH)_2$
(d) $Be(OH)_2$, $Zn(OH)_2$.

71. Which of the following is a carbonate ore?

(a) pyrolusite (b) malachite
(c) diaspore (d) cassiterite.

72. $^{238}_{92}U$ emits 8 α-particles and 6 β-particles. The neutron/proton ratio in the product nucleus is

(a) 60/41 (b) 61/40
(c) 62/41 (d) 61/42.

73. The correct order for the wavelength of absorption in the visible region is

(a) $[Ni(NO_2)_6]^{4-} < [Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+}$
(b) $[Ni(NO_2)_6]^{4-} < [Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+}$
(c) $[Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+} < [Ni(NO_2)_6]^{4-}$
(d) $[Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+} < [Ni(NO_2)_6]^{4-}$

74. F_2 formed by reacting K_2MnF_6 with

(a) SbF_5 (b) MnF_3
(c) $KSbF_6$ (d) MnF_4.

75. The isoelectronic pair is

(a) Cl_2O, ICl_2^- (b) ICl_2^-, ClO_2
(c) IF_2^+, I_3^- (d) ClO_2^-, ClF_2^+.

76. Which of the following chemicals are used to manufacture methyl isocyanate that caused "Bhopal Tragedy"?

(i) methylamine (ii) phosgene
(iii) phosphine (iv) dimethylamine.
(a) (i) and (iii) (b) (iii) and (iv)
(c) (i) and (ii) (d) (ii) and (iv).

77. α-Particles can be detected using

(a) thin aluminium sheet
(b) barium sulphate
(c) zinc sulphide screen
(d) gold foil.

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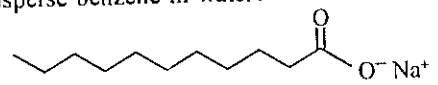
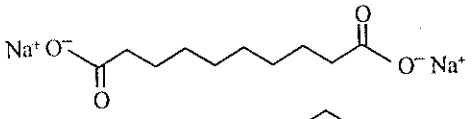
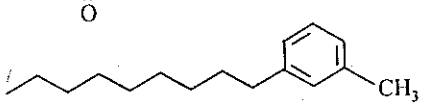
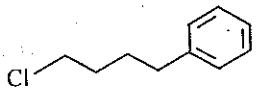
78. Which of the following molecules is most suitable to disperse benzene in water?

(a) 

(b) 

(c) 

(d) 

79. The chemical reaction,

$2AgCl_{(s)} + H_{2(g)} \rightarrow 2HCl_{(aq)} + 2Ag_{(s)}$

taking place in a galvanic cell is represented by the notation

(a) $Pt_{(s)} | H_{2(g)}$, 1 bar | 1M $KCl_{(aq)} | AgCl_{(s)} | Ag_{(s)}$

(b) $Pt_{(s)} | H_{2(g)}$, 1 bar | 1M $HCl_{(aq)} | 1MAg^{+}_{(aq)} | Ag_{(s)}$

(c) $Pt_{(s)} | H_{2(g)}$, 1 bar | 1M $HCl_{(aq)} | AgCl_{(s)} | Ag_{(s)}$

(d) $Pt_{(s)} | H_{2(g)}$, 1 bar | 1M $HCl_{(aq)} | Ag_{(s)} | AgCl_{(s)}$

80. If Z is the number of atoms in the unit cell that represents the closest packing sequence ... $A\ B\ C\ A\ B\ C$ ..., the number of tetrahedral voids in the unit cell is equal to

(a) Z (b) $2Z$

(c) $Z/2$ (d) $Z/4$.

81. ΔH_f° (298 K) of methanol is given by the chemical equation

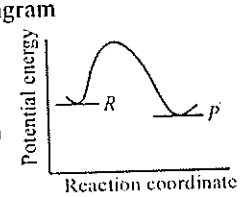
(a) $CH_{4(g)} + \frac{1}{2}O_{2(g)} \rightarrow CH_3OH_{(g)}$

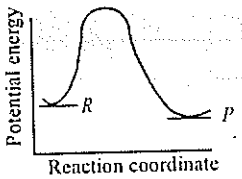
(b) C (graphite) $+ \frac{1}{2}O_{2(g)} + 2H_{2(g)} \rightarrow CH_3OH_{(l)}$

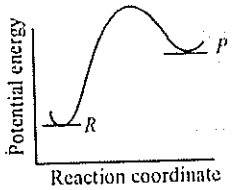
(c) C (diamond) $+ \frac{1}{2}O_{2(g)} + 2H_{2(g)} \rightarrow CH_3OH_{(l)}$

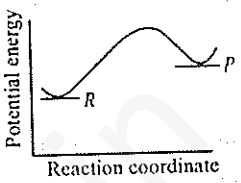
(d) $CO_{(g)} + 2H_{2(g)} \rightarrow CH_3OH_{(l)}$.

82. An endothermic reaction with high activation energy for the forward reaction is given by the diagram

(a) 

(b) 

(c) 

(d) 

83. When 10 ml of 0.1 M acetic acid ($pK_a = 5.0$) is titrated against 10 ml of 0.1 M ammonia solution ($pK_b = 5.0$), the equivalence point occurs at pH

(a) 5.0 (b) 6.0

(c) 7.0 (d) 9.0

84. The most probable radius (in pm) for finding the electron in He^{+} is

(a) 0.0 (b) 52.9

(c) 26.5 (d) 105.8

85. For the reaction of one mole of zinc dust with one mole of sulphuric acid in a bomb calorimeter, ΔU and w corresponds to

(a) $\Delta U < 0$, $w = 0$ (b) $\Delta U < 0$, $w < 0$

(c) $\Delta U > 0$, $w = 0$ (d) $\Delta U > 0$, $w > 0$.

86. For reaction $aA \rightarrow xP$, when $[A] = 2.2$ mM, the rate was found to be 2.4 mM s^{-1}. On reducing concentration of A to half, the rate changes to 0.6 mM s^{-1}. The order of reaction with respect to A is

(a) 1.5 (b) 2.0

(c) 2.5 (d) 3.0

87. For reaction, $2NOCl_{(g)} = 2NO_{(g)} + Cl_{2(g)}$, K_C at 427°C is 3×10^{-6} L. mol^{-1}. The value of K_p is nearly

(a) 7.50×10^{-5} (b) 2.50×10^{-5}

(c) 2.50×10^{-4} (d) 1.75×10^{-4}.

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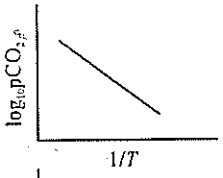
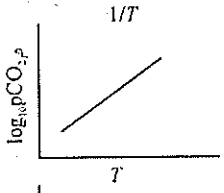
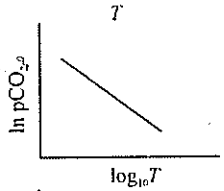
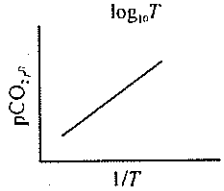
88. For the chemical equilibrium,
$CaCO_{3\,(s)} \rightleftharpoons CaO_{(s)} + CO_{2\,(g)}$,
$\Delta H_r°$ can be determined from which one of the following plots?

(a) 

(b) 

(c) 

(d) 

89. Among the following the strongest nucleophile is
(a) C_2H_5SH (b) CH_3COO^-
(c) CH_3NH_2 (d) $NCCH_2^-$

90. The major product formed in the following reaction is

$$CH_3-\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2Br \xrightarrow[CH_3OH]{CH_3O^-}$$

(a) $CH_3-\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2OCH_3$

(b) $CH_3-\underset{\underset{OCH_3}{|}}{CH}-CH_2CH_3$

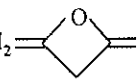
(c) $CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2$ (d) $CH_3-\underset{\underset{OCH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$

91. The major product obtained on treatment of $CH_3CH_2CH(F)CH_3$ with CH_3O^-/CH_3OH is
(a) $CH_3CH_2CH(OCH_3)CH_3$
(b) $CH_3CH = CHCH_3$
(c) $CH_3CH_2CH = CH_2$
(d) $CH_3CH_2CH_2CH_2OCH_3$.

92. Among the following the most stable compound is
(a) *cis*-1,2-cyclohexanediol
(b) *trans*-1,2-cyclohexanediol
(c) *cis*-1,3-cyclohexenediol
(d) *trans*-1,3-cyclohexanediol.

93. 3-Phenylpropene on reaction with HBr gives (as a major product)
(a) $C_6H_5CH_2CH(Br)CH_3$
(b) $C_6H_5CH(Br)CH_2CH_3$
(c) $C_6H_5CH_2CH_2CH_2Br$
(d) $C_6H_5CH(Br)CH = CH_2$.

94. $CH_3CO_2C_2H_5$ on reaction with sodium ethoxide in ethanol gives *A*, which on heating in the presence of acid gives *B*. Compound *B* is
(a) CH_3COCH_2COOH (b) CH_3COCH_3

(c) CH_2= 

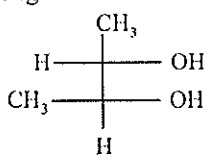
(d) $CH_2=C(OC_2H_5)(OC_2H_5)$

95. Among the following which one does not act as an intermediate in Hofmann rearrangement?
(a) RNCO (b) $R\ddot{C}O\ddot{N}$
(c) $RCO\ddot{N}HBr$ (d) RNC

96. Pyridine is less basic than triethylamine because
(a) pyridine has aromatic character
(b) nitrogen in pyridine is sp^2 hybridised
(c) pyridine is a cyclic system
(d) in pyridine, lone pair of nitrogen is delocalised.

97. Which one of the following biomolecules is insoluble in water?
(a) α-keratin (b) haemoglobin
(c) ribonuclease (d) adenine.

98. Correct configuration of the following is



(a) 1S, 2S (b) 1S, 2R
(c) 1R, 2S (d) 1R, 2R.

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99. Which one of the following statements is true for protein synthesis (translation)?
(a) amino acids are directly recognized by *m*-RNA
(b) the third base of the codon is less specific
(c) only one codon codes for an amino acid
(d) every *t*-RNA molecule has more than one amino acid attachment.

100. $C_6H_5CONHCH_3$ can be converted into $C_6H_5CH_2NHCH_3$ by
(a) $NaBH_4$ (b) H_2 - Pd/C
(c) $LiAl_4$ (d) Zn-Hg/HCl.

Directions for questions 101-120 : *In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as*
(a) If both assertion and reason are true and reason is the correct explanation of assertion
(b) If both assertion and reason are true but reason is not the correct explanation of assertion
(c) If assertion is true but reason is false
(d) If both assertion and reason are false.

101. Assertion : Reaction of SO_2 and H_2S in the presence of Fe_2O_3 catalyst gives elemental sulphur.
Reason : SO_2 is a reducing agent.

102. Assertion : SiF_6^{2-} is known but $SiCl_6^{2-}$ is not.
Reason : Size of fluorine is small and its lone pair of electrons interacts with *d*-orbitals of Si strongly.

103 Assertion : Borax bead test is not suitable for Al(III).
Reason : Al_2O_3 is insoluble in water.

104. Assertion : Ozone is a powerful oxidising agent in comparison to O_2.
Reason : Ozone is diamagnetic but O_2 is paramagnetic.

105. Assertion : Potassium ferrocyanide is diamagnetic whereas potassium ferricyanide is paramagnetic.
Reason : Crystal field splitting in ferroeyanide ion is greater than that of ferricyanide ion.

106. Assertion : Addition of NH_4OH to an aqueous solution of $BaCl_2$ in the presence of NH_4Cl (excess) precipitates $Ba(OH)_2$.
Reason : $Ba(OH)_2$ is insoluble in water.

107. Assertion : $SeCl_4$ does not have a tetrahedral structure.
Reason : Se in $SeCl_4$ has two lone pairs.

108. Assertion : The molecular weight of acetic acid determined by depression in freezing point method in benzene and water was found to be different.
Reason : Water is polar and benzene is non-polar.

109. Assertion : Compressibility factor for hydrogen varies with pressure with positive slope at all pressures.
Reason : Even at low pressures, repulsive forces dominate hydrogen gas.

110. Assertion : First ionization energy for nitrogen is lower than oxygen.
Reason : Across a period effective nuclear charge decreases.

111. Assertion : B_2 molecule is diamagnetic.
Reason : The highest occupied molecular orbital is of σ type.

112. Assertion : Rate of hydrolysis of methyl chloride to methanol is higher in DMF than in water.
Reason : Hydrolysis of methyl chloride follows second order kinetics.

113. Assertion : Galvanised iron does not rust.
Reason : Zinc has a more negative electrode potential than iron.

114. Assertion : Extraction of iron metal from iron oxide ore is carried out by heating with coke.
Reason : The reaction $Fe_2O_{3\,(s)} \rightarrow Fe_{(s)} + 3/2\ O_{2\,(g)}$ is a spontaneous process.

115. Assertion : Rates of nitration of benzene and hexadeuterobenzene are different.
Reason : C – H bond is stronger than C – D bond.

116. Assertion : *t*-Butyl methyl ether is not prepared by the reaction of *t*-butyl bromide with sodium methoxide.
Reason : Sodium methoxide is a strong nucleophile.

117. Assertion : Maltose is a reducing sugar which gives two moles of D-glucose on hydrolysis.
Reason : Maltose has a 1,4-β-glycosidic linkage.

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118. Assertion : p-$O_2N - C_6H_5COCH_3$ is prepared by Friedel Crafts acylation of nitrobenzene.
Reason : Nitrobenzene easily undergoes electrophilic substitution reaction.

119. Assertion : Alkyl isocyanides in acidified water give alkyl formamides.
Reason : In isocyanides, carbon first acts as a nucleophile and then as an electrophile.

120. Assertion : Cyclopentadienyl anion is much more stable than allyl anion.
Reason : Cyclopentadienyl anion is aromatic in character.

BIOLOGY

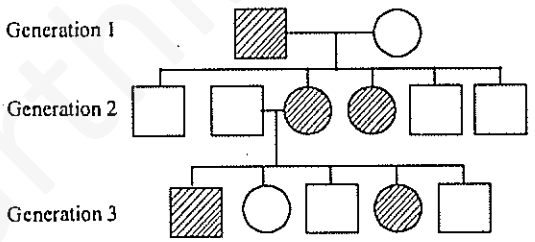
121. Based on cellular mechanisms there are two major types of regeneration found in the animals. Which one of the following is the correct example of the type mentioned?
(a) Morphallaxis – Regeneration of two transversely cut equal pieces of a Hydra into two small Hydras.
(b) Epimorphosis - Replacement of old and dead erythrocytes by the new ones.
(c) Morphallaxis - Healing up of a wound in the skin.
(d) Epimorphosis - Regeneration of crushed and filtered out pieces of a *Planaria* into as many new Planarians.

122. Which one of the following four secretions is correctly matched with its source, target and nature of action?

	Secretion	Source	Target	Action
(a)	Gastrin	Stomach lining	Oxyntic cells	Production of HCl
(b)	Inhibin	Sertoli cells	Hypoth-alamus	Inhibition of secre-tion of gonadotropin releasing hormone
(c)	Enterokinase	Duodenum	Gall bladder	Release of bile juice
(d)	Atrial Natriuretic Factor (ANF)	Sinu atrial node(SAN) M-cells of Atria	Juxta-glomerular apparatus (JGA)	Inhibition of release of renin

123. Which one of the following four glands is correctly matched with the accompanying description ?
(a) Thyroid - hyperactivity in young children causes cretinism
(b) Thymus - starts undergoing atrophy after puberty
(c) Parathyroid - secretes parathormone which promotes movement of calcium ions from blood into bones during calcification
(d) Pancreas - Delta cells of the Islets of Langerhans secrete a hormone which stimulates glycolysis in liver.

124. Given below is a pedigree chart showing the inheritance of a certain sex-linked trait in humans.



Key:
Unaffected male
Affected male
Unaffected female
Affected female

The trait traced in the above pedigree chart is
(a) dominant X-linked
(b) recessive X-linked
(c) dominant Y-linked
(d) recessive Y-linked.

125. A cross section at the midpoint of the middle piece of a human sperm will show
(a) centriole, mitochondria and 9 + 2 arrangement of microtubules
(b) centriole and mitochondria
(c) mitochondria and 9 + 2 arrangement of microtubules
(d) 9 + 2 arrangement of microtubules only.

126. Which one of the following is a correct statement?
(a) "Bt" in "Bt-cotton" indicates that it is a genetically modified organism produced through biotechnology.

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(b) Somatic hybridization involves fusion of two complete plant cells carrying desired genes.
(c) The anticoagulant hirudin is being produced from transgenic *Brassica napus* seeds.
(d) "Flavr Savr" variety of tomato has enhanced the production of ethylene which improves its taste.

127. An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as:
(a) histamine and dopamine
(b) histamine and kinins
(c) interferons and opsonin
(d) interferons and histones.

128. Which one of the following pairs of geographical areas show maximum biodiversity in our country?
(a) Sunderbans and Rann of Kutch
(b) Eastern Ghats and West Bengal
(c) Eastern Himalaya and Western Ghats
(d) Kerala and Punjab.

129. Genetic diversity in agricultural crops is threatened by :
(a) introduction of high yielding varieties
(b) intensive use of fertilizers
(c) extensive intercropping
(d) intensive use of biopesticides.

130. One of the *ex situ* conservation methods for endangered species is
(a) wildlife sanctuaries
(b) biosphere reserves
(c) eryopreservation (d) national parks.

131. Formation of non-functional methaemoglobin causes blue-baby syndrome. This is due to
(a) excess of arsenic concentration in drinking water
(b) excess of nitrates in drinking water
(c) deficiency of iron in food
(d) increased methane content in the atmosphere.

132. Two of the body parts which do not appear in MRI may be:
(a) molar teeth and eye lens
(b) scapula and canines
(c) ligaments and ribs
(d) tendons and premolars.

133. A young drug addict used to show symptoms of depressed brain activity, feeling of calmness, relaxation and drowsiness. Possibly he was taking
(a) amphetamine (b) marijuna
(c) pethidine (d) valium.

134. Antigen binding site in an antibody is found between
(a) two light chains
(b) two heavy chains
(c) one heavy and one light chain
(d) either between two light chains or between one heavy and one light chain depending upon the nature of antigen.

135. Which one of the following events is correctly matched with the time period in a normal menstrual cycle?
(a) release of egg : 5th day
(b) endometrium regenerates : 5 - 10 days
(c) endometrium secretes nutrients for implantation : 11-18 days
(d) rise in progesterone level : 1 - 15 days.

136. A tumor inducing plasmid widely used in the production of transgenic plants is that of
(a) *Escherichia coli*
(b) *Bacillus thuringiensis*
(c) *Staphylococcus aureus*
(d) *Agrobacterium tumefaciens.*

137. Which one of the following statement pertaining to pollutants is correct?
(a) DDT is a non-biodegradable pollutant
(b) excess fluoride in drinking water causes osteoporosis
(c) excess cadmium in drinking water causes black foot disease
(d) methylmercury in water may cause "Itai Itai" disease.

138. Which one of the following statements is correct with respect to salt water balance inside the body of living organisms?
(a) when water is not available camels do not produce urine but store urea in tissues
(b) Salmon fish excretes lot of stored salt through gill membrane when in fresh water.
(c) *Paramecium* discharges concentrated salt solution by contractile vacuoles

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(d) The body fluids of fresh water animals are generally hypotonic to surrounding water.

139. The "cri-du-chat" syndrome is caused by change in chromosome structure involving
(a) deletion (b) duplication
(c) inversion (d) translocation.

140. The family containing mustard and its main characters are
(a) Brassicaceae – Tetramerous flowers, six stamens, bicarpellary gynoecium, siliqua type fruit
(b) Brassicaceae – Pentamerous flowers, many stamens, pentacarpellary gynoecium, capsule type fruit
(c) Solanaceae - Pentamerous flowers, five stamens, bicarpellary gynoecium, berry type fruit
(d) Poaceae – Trimerous flowers, three stamens, monocarpellary gynoecium, caryopsis type of fruit.

141. Grain colour in wheat is determined by three pairs of polygenes. Following the cross AABBCC (dark colour) x aabbcc (light colour), in F_2 generation what proportion of the progeny is likely to resemble either parent?
(a) none (b) less than 5 percent
(c) one third (d) half.

142. Which one of the following statements pertaining to plant structure is correct?
(a) cork lacks stomata, but lenticels carry out transpiration
(b) passage cells help in transfer of food from cortex to phloem
(c) sieve tube elements possess cytoplasm but no nuclei
(d) the shoot apical meristem has a quiescent centre.

143. When synapsis is complete all along the chromosome, the cell is said to have entered a stage called
(a) zygotene (b) pachytene
(c) diplotene (d) diakinesis.

144. Primary source of allelic variation is
(a) independent assortment
(b) recombination
(c) mutation (d) polyploidy

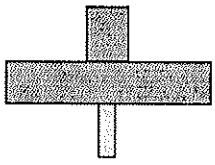
145. Many cells function properly and divide mitotically even though they do not have
(a) plasma membrane (b) cytoskeleton
(c) mitochondria (d) plastids.

146. Three of the following statements regarding cell organelles are correct while one is wrong. Which one is wrong?
(a) Lysosomes are double membraned vesicles budded off from Golgi apparatus and contain digestive enzymes.
(b) Endoplasmic reticulum consists of a network of membranous tubules and helps in transport, synthesis and secretion.
(c) Leucoplasts are bound by two membranes, lack pigment but contain their own DNA and protein synthesizing machinery.
(d) Sphaerosomes are single membrane bound and are associated with synthesis and storage of lipids.

147. In which one of the following would you expect to find glyoxysomes?
(a) endosperm of wheat
(b) endosperm of castor
(c) palisade cells in leaf
(d) root hairs.

148. Which one of the following correctly represents an organism and its ecological niche?
(a) *Vallisneria* and pond
(b) desert locust (*Scistocerca*) and desert
(c) plant lice (aphids) and leaf
(d) vultures and dense forest.

149. Given below is one of the types of ecological pyramids.



This type represents
(a) pyramid of numbers in a grassland
(b) pyramid of biomass in a fallow land
(c) pyramid of biomass in a lake
(d) energy pyramid in a spring.

150. The given graph shows the effect of substrate concentration on the rate of reaction of the enzyme green-gram-phosphatase
What does the graph indicate?

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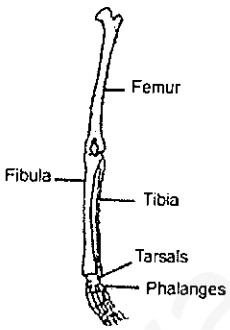
(a) The rate of enzyme reaction is directly proportional to the substrate concentration
(b) Presence of an enzyme inhibitor in the reaction mixture
(c) Formation of an enzyme-substrate complex
(d) at higher substrate concentration the pH inereases.

151. Which one of the following groups of structures/ organs have similar function?
(a) Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in *Amoeba.*
(b) Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubules in rat.
(c) Antennae of cockroach, tympanum of frog and clitellum of earthworm.
(d) Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish.

152. Given diagram shows bone of the left human hindlimb as seen from front. It has certain mistakes in labeling. Two of the wrongly labelled bones are:

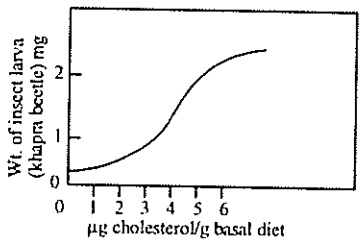


(a) tibia and tarsals
(b) femur and fibula
(c) fibula and phalanges
(d) tarsals and femur.

153. Electroporation procedure involves :
(a) fast passage of food through sieve pores in phloem elements with the help of electric stimulation
(b) opening of stomatal pores during night by artificial light
(c) making transient pores in the cell membrane to introduce gene constructs
(d) purification of saline water with the help of a membrane system.

54. Somaclonal variation appears in
(a) organisms produced through somatic hybridization
(b) plants growing in highly polluted conditions
(c) apomictic plants
(d) tissue culture raised plants.

55. In an experiment freshly hatched larvae of an insect (Khapra beetle) were reared on a basal diet (complete diet without cholesterol) with increasing amounts of cholesterol. Results obtained are shown in the graph given in the table :
The graph indicates that



(a) cholesterol is an essential dietary requirement of khapra beetle
(b) growth of khapra beetle is directly proportional to cholesterol concentration
(c) cholesterol concentration of 2 $\mu g/g$ diet is the optimum level
(d) growth of khapra beetle is inhibited when cholesterol concentration exceeds 5 $\mu g/g$ diet.

156. Which one of the following is correct matching of a plant, its habit and the forest type where it normally occurs?
(a) *Prosopis*, tree, scrub
(b) *Saccharum*, grass, forest
(c) *Shorea robusta*, herb, tropical rain forest
(d) *Acacia catechu*, tree, coniferous forest.

157. cDNA probes are copied from the messenger RNA molecules with the help of
(a) restriction enzymes
(b) reverse transcriptase
(c) DNA polymerase
(d) adenosine deaminase.

158. Gibberellins can promote seed germination because of their influence on
(a) rate of cell division
(b) production of hydrolyzing enzymes
(c) synthesis of abscisic acid
(d) absorption of water through hard seed coat.

159. Which one of the following features is common in silverfish, scorpion, dragonfly and prawn?
(a) Three pairs of legs and segmented body
(b) Chitinous cuticle and two pairs of antennae
(c) Jointed appendages and chitinous exoskeleton
(d) Cephalothorax and tracheae.

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160. Double fertilization involves
(a) fertilization of the egg by two male gametes
(b) fertilization of two eggs in the same embryo sac by two sperms brought by one pollen tube
(c) fertilization of the egg and the central cell by two sperms brought by different pollen tubes
(d) fertilization of the egg and the central cell by two sperms brought by the same pollen tube.

In the following questions (161-180), a statement of assertion (A) is followed by a statement of reason (R).

(a) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark *a*
(b) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark *b*
(c) If Assertion is true statement but Reason is false, then mark *c*
(d) If both Assertion and Reason are false statements, then mark *d*.

161. *Assertion :* Senescence is the time when age associated defects are manifested.
Reason : Certain genes may be undergoing sequential switching on and off during one's life.

162. *Assertion :* In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryote).
Reason : Both bacteria and yeast multiply very fast to form huge populations which express the desired gene.

163. *Assertion :* A suspended particulate matter (SPM) is an important pollutant released by diesel vehicles.
Reason : Catalytic converters greatly reduce pollution caused by automobiles.

164. *Assertion :* Methane component of green house gases contributing to global warming is about 20 percent.
Reason : Introduction of multi-point fuel injection engines in automobiles has decreased methane content in the exhausts.

165. *Assertion :* Interferons are a type of antibodies produced by body cells infected by bacteria.
Reason : Interferons stimulate inflammation at the site of injury.

166. *Assertion :* Organ transplantation patients are given immunosuppressive drugs.
Reason : Transplanted tissue has antigens which stimulate the specific immune response of the recipient.

167. *Assertion :* Persons suffering from haemophilia fail to produce blood clotting factor VIII.
Reason : Prothrombin producing platelets in such persons are found in very low concentration.

168. *Assertion :* In humans, the gamete contributed by the male determines whether the child produced will be male or female.
Reason : Sex in humans is a polygenic trait depending upon a cumulative effect of some genes on X-chromosome and some on Y-chromosome.

169. *Assertion :* Mitochondria and chloroplasts are semi-autonomous organelles.
Reason : They are formed by division of pre-existing organelles as well as contain DNA but lack protein synthesizing machinery.

170. *Assertion :* Replication and transcription occur in the nucleus but translation occurs in the cytoplasm.
Reason : *m*RNA is transferred from the nucleus into the cytoplasm where ribosomes and amino acids are available for protein synthesis.

171. *Assertion :* The fungi are widespread in distribution and they even live on or inside other plants and animals.
Reason : Fungi are able to grow anywhere on land, water or on other organisms because they have a variety of pigments, including chlorophyll, carotenoids, fucooxanthin and phycoerythrin.

172. *Assertion :* C_4 photosynthetic pathway is more efficient than the C_3 pathway.
Reason : Photorespiration is suppressed in C_4 plants.

173. *Assertion :* Human ancestors never used their tails and so the tail expressing gene has disappeared in them.
Reason : Lamarck's theory of evolution is popularly called theory continuity of germ plasm.

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174. *Assertion* : Presently, the global atmosphere is warming up.
Reason : The depletion of stratospheric ozone layer has resulted in increase in ultraviolet radiations reaching the earth.

175. *Assertion* : Comparative biochemistry provides a strong evidence in favour of common ancestry of living beings.
Reason : Genetic code is universal.

176. *Assertion* : Darwin's finches show a variety of beaks suited for eating large seeds, flying insects and cactus seeds.
Reason : Ancestral seed-eating stock of Darwin's finches radiated out from South American mainland to different geographical areas of the Galapagos Islands, where they found competitor-free new habitats.

177. *Assertion* : The atmospheric concentration of CO_2 at which photosynthesis just compensates for respiration is referred to as CO_2 compensation point.
Reason : The CO_2 compensation point is reached when the amount of CO_2 uptake is less than that generated through respiration because the level of CO_2 in the atmosphere is more than that required for achieving CO_2 compensation point.

178. *Assertion* : The age-sex structure of human population in countries like France and Germany gives a steep pyramid.
Reason : In countries like Sudan and India the population is increasing at a rapid rate.

179. *Assertion* : The duck-billed *Platypus* and the spiny ant-eater, both are egg-laying animals yet they are grouped under mammals.
Reason : Both of them have seven cervical vertebrae and 12 pairs of cranial nerves.

180. *Assertion* : *Agrobacterium tumefaciens* is popular in genetic engineering because this bacterium is associated with the roots of all cereal and pulse crops.
Reason : A gene incorporated in the bacterial chromosomal genome gets automatically transferred to the crop with which the bacterium is associated.

GENERAL KNOWLEDGE

181. Metaphysics refers to :
(a) A branch of philosophy concerned with the rational query of reality.
(b) A branch of physics concerned with investigation of reality.
(c) Meta-analysis of physics for the purpose of theory of relativity.
(d) Analysis of human body at atomic level.

182. Who is called as numismatist?
(a) an expert on numerology
(b) a numerator
(c) an expert on mathematics
(d) a person who studies coins.

183. Anjali Bhagwat is related to which field:
(a) Lawn tennis (b) Badminton
(c) Shooting (d) Athletics.

184. Who received Stains International award for religion harmony?
(a) Teesta Setalvad
(b) Kuldeep Nayar
(c) Bharatiya Vidya Bhawan
(d) Pope John Paul.

185. A 'dirty' nuclear bomb means :
(a) it has small amount of cobalt 60
(b) it involves low grade fusion reaction
(c) it involves low grade fission reaction
(d) it involves small Ce-137.

186. National Inland Navigation Institute (NINI) is situated in:
(a) Patna
(b) Kolkata
(c) Goa
(d) Gomukh, Uttaranchal.

187. 'Blogs' means:
(a) On line journals where cyber-diarists unreveal their stories.
(b) Black spots in somebody's life.
(c) Big logs used to cross the river in hills.
(d) Big blocks of land used for grazing animals.

188. What is the colour of Black Box, that is found in aircraft?
(a) Orange (b) Red
(c) Blue (d) Black.

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189. Which author was a Bengali writer and an Oscar-winning film director?
(a) Bankimchandra Chatterjee
(b) Satyajit Ray
(c) Chhabi Biswas
(d) Rabindranath Tagore.

190. What is the symbol of Laloo Prasad Yadav's RJD party?
(a) Lantern (b) Tea Leaves
(c) Elephant (d) Palm.

191. Where is the Tibetan government-in-exile based?
(a) Delhi (b) Dharamsala
(c) Phomphenh (d) London.

192. What is true of Leonardo da Vinci's Mona Lisa?
(a) he painted without a model
(b) the model was the wife of a client
(c) he dreampt her in the night
(d) the model was an unmarried women.

193. Which is the annual pilgrimage that every Muslim should make once in the lifetime?
(a) Haj (b) Sharjah
(c) Jihad (d) Zakat.

194. What is the term used in e-mail and online conversations to convey mood along with the words?
(a) smiley (b) pictures
(c) emoticon (d) flames.

195. Whose quote is "I hear and I forget. I see and I remember. I do and I understand"?
(a) Caskie Stinnet (b) Mickey Mantle
(c) Confucious
(d) Arthur Schopenhauer.

196. Whose autobiography is "Sunny Days"?
(a) Sunil Gavaskar (b) Geofrey Boycott
(c) Sunny Deol (d) Sunil Shetty.

197. Which age in Indian history is referred to as the "Golden Age"?
(a) Maurya (b) Gupta
(c) Mughal (d) Ancient.

198. Which novel of Amitav Ghosh is called *Esteremi Orienti* in its Italian version?
(a) In An Antique Land
(b) Dancing in Cambodia
(c) The Circle of Reason
(d) The Shadow Lines.

199. Which of the following is President A.P.J. Abdul Kalam's autobiography?
(a) Wings of Fire (b) Crossroads
(c) Ignited Minds: Unleashing the Power Within India
(d) My experiment with truth.

200. Which of the following units of measurement is not named after a person?
(a) Hertz (b) Curie
(c) Barleycorn (d) Apgar.

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