

SOLVED PAPER

AIIMS - 2006

Time : 3½ Hours

Max. Marks : 200

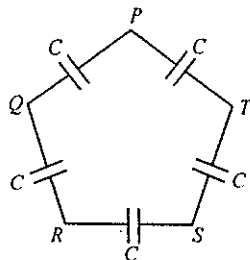
PHYSICS

1. In refraction, light waves are bent on passing from one medium to the second medium, because in the second medium
 - (a) the frequency is different
 - (b) the coefficient of elasticity is different
 - (c) the speed is different
 - (d) the amplitude is smaller.
2. Two spheres of same size, one of mass 2 kg and another of mass 4 kg are dropped simultaneously from the top of Qutab Minar (height ≈ 72 m). When they are 1 m above the ground the two spheres have the same
 - (a) momentum
 - (b) kinetic energy
 - (c) potential energy
 - (d) acceleration.
3. The moment of inertia of a rod about an axis through its centre and perpendicular to it is $\frac{1}{12}ML^2$ (where M is the mass and L , the length of the rod). The rod is bent in the middle so that the two halves make an angle of 60° . The moment of inertia of the bent rod about the same axis would be
 - (a) $\frac{1}{48}ML^2$
 - (b) $\frac{1}{12}ML^2$
 - (c) $\frac{1}{24}ML^2$
 - (d) $\frac{ML^2}{8\sqrt{3}}$
4. A boat at anchor is rocked by waves whose crests are 100 m apart and velocity is 25 m/sec. The boat bounces up once in every
 - (a) 2500 s
 - (b) 75 s
 - (c) 4 s
 - (d) 0.25 s.
5. By sucking through a straw, a student can reduce the pressure in his lungs to 750 mm of Hg (density $= 13.6 \text{ g/cm}^3$). Using the straw, he can drink water from a glass upto a maximum depth of
 - (a) 10 cm
 - (b) 75 cm
 - (c) 13.6 cm
 - (d) 1.36 cm.
6. Two parallel large thin metal sheets have equal surface charge densities ($\sigma = 26.4 \times 10^{-12} \text{ C/m}^2$) of opposite signs. The electric field between these sheets is
 - (a) 1.5 N/C
 - (b) $1.5 \times 10^{-10} \text{ N/C}$
 - (c) 3 N/C
 - (d) $3 \times 10^{-10} \text{ N/C}$.
7. The magnetic moment has dimensions of
 - (a) $[LA]$
 - (b) $[L^2A]$
 - (c) $[LT^{-1}A]$
 - (d) $[L^2T^{-1}A]$.
8. A wire mesh consisting of very small squares is viewed at a distance of 8 cm through a magnifying converging lens of focal length 10 cm, kept close to the eye. The magnification produced by the lens is
 - (a) 5
 - (b) 8
 - (c) 10
 - (d) 20.
9. Hard X-rays for the study of fractures in bones should have a minimum wavelength of 10^{-11} m . The accelerating voltage for electrons in X-ray machine should be
 - (a) $< 124.2 \text{ kV}$
 - (b) $> 124.2 \text{ kV}$
 - (c) between 60 kV and 70 kV
 - (d) $= 100 \text{ kV}$.
10. In photoelectric effect, the electrons are ejected from metals if the incident light has a certain minimum
 - (a) wavelength
 - (b) frequency
 - (c) amplitude
 - (d) angle of incidence.
11. A lens is made of flint glass (refractive index $= 1.5$). When the lens is immersed in a liquid of refractive index 1.25, the focal length
 - (a) increases by a factor of 1.25
 - (b) increases by a factor of 2.5
 - (c) increases by a factor of 1.2
 - (d) decreases by a factor of 1.2
12. The voltage of clouds is 4×10^6 volt with respect to ground. In a lightening strike lasting 100 msec, a charge of 4 coulombs is delivered to the ground.

The power of the lightning strike is

- (a) 160 MW (b) 80 MW
(c) 20 MW (d) 500 MW.

13. Five capacitors, each of capacitance value C are connected as shown in the figure. The ratio of capacitance between P and R , and the capacitance between P and Q is



- (a) 3 : 1 (b) 5 : 2
(c) 2 : 3 (d) 1 : 1.

14. A stone thrown into still water, creates a circular wave pattern moving radially outwards. If r is the distance measured from the centre of the pattern, the amplitude of the wave varies as

- (a) $r^{-1/2}$ (b) r^{-1}
(c) r^{-2} (d) $r^{-3/2}$.

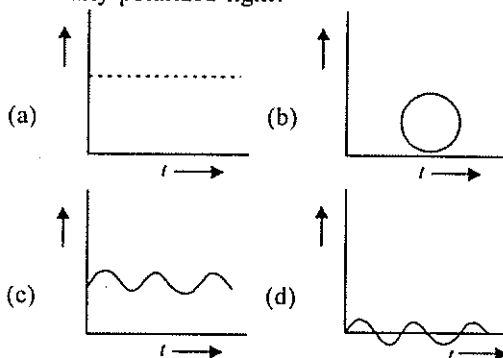
15. For inelastic collision between two spherical rigid bodies

- (a) the total kinetic energy is conserved
(b) the total potential energy is conserved
(c) the linear momentum is not conserved
(d) the linear momentum is conserved.

16. When a p - n diode is reverse biased, then

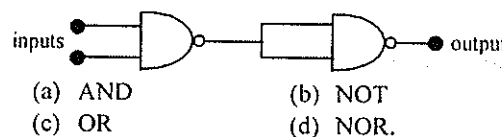
- (a) no current flows
(b) the depletion region is increased
(c) the depletion region is reduced
(d) the height of the potential barrier is reduced.

17. Which of the following diagrams represents the variation of electric field vector with time for a circularly polarized light?



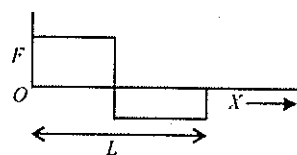
18. The operation of a nuclear reactor is said to be critical, if the multiplication factor (κ) has a value
(a) 1 (b) 1.5
(c) 2.1 (d) 2.5

19. The circuit given below represents which of logic operations?

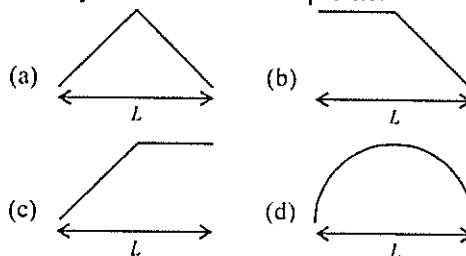


- (a) AND (b) NOT
(c) OR (d) NOR.

20. A person used force (F), shown in figure to move a load with constant velocity on surface.



Identify the correct surface profile.



21. Three objects coloured black, gray and white can withstand hostile conditions upto 2800°C . These objects are thrown into a furnace where each of them attains a temperature of 2000°C . Which object will glow brightest?

- (a) the white object (b) the black object
(c) all glow with equal brightness
(d) gray object.

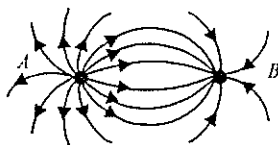
22. Two balloons are filled, one with pure He gas and other by air, respectively. If the pressure and temperature of these balloons are same then the number of molecules per unit volume is

- (a) more in the He filled balloon
(b) same in both balloons
(c) more in air filled balloon
(d) in the ratio of 1 : 4.

23. Flash light equipped with a new set of batteries, produces bright white light. As the batteries wear out,

- (a) the light intensity gets reduced with no change in its colour
 (b) light colour changes first to yellow and then red with no change in intensity
 (c) it stops working suddenly while giving white light
 (d) colour changes to red and also intensity gets reduced.

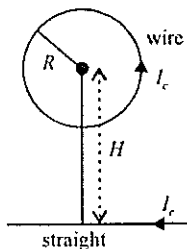
24. The spatial distribution of the electric field due to two charges (A, B) is shown in figure.



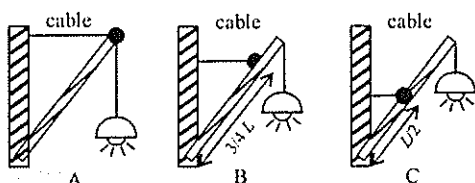
Which one of the following statements is correct?

- (a) A is +ve and B -ve and $|A| > |B|$
 (b) A is -ve and B +ve; $|A| = |B|$
 (c) both are +ve but $A > B$
 (d) both are -ve but $A > B$.

25. Circular loop of a wire and a long straight wire carry currents I_c and I_s respectively as shown in figure. Assuming that these are placed in the same plane, the magnetic fields will be zero at the centre of the loop when separation H is



- (a) $\frac{I_c R}{I_s \pi}$ (b) $\frac{I_c R}{I_s \pi}$
 (c) $\frac{\pi I_c}{I_s R}$ (d) $\frac{I_c \pi}{I_s R}$
26. If a street light of mass M is suspended from the end of a uniform rod of length L in different possible patterns as shown in figure, then



- (a) pattern A is more sturdy
 (b) pattern B is more sturdy
 (c) pattern C is more sturdy
 (d) all will have same sturdiness.

27. ${}^{238}_{92}\text{U}$ has 92 protons and 238 nucleons. It decays by emitting an alpha particle and becomes

- (a) ${}^{234}_{92}\text{U}$ (b) ${}^{234}_{90}\text{Th}$
 (c) ${}^{235}_{92}\text{U}$ (d) ${}^{237}_{93}\text{Np}$.

28. The fossil bone has a ${}^{14}\text{C} : {}^{12}\text{C}$ ratio, which is $[1/16]$ of that in a living animal bone. If the half-life time of ${}^{14}\text{C}$ is 5730 years, then the age of the fossil bone is

- (a) 11460 years (b) 17190 years
 (c) 22920 years (d) 45840 years.

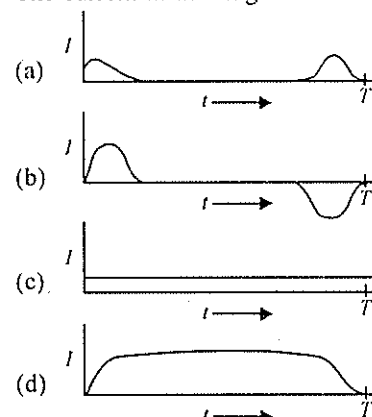
29. Which one of the following is a possible nuclear reaction?

- (a) ${}^{10}_5\text{B} + {}^4_2\text{He} \rightarrow {}^{13}_7\text{N} + {}^1_1\text{H}$
 (b) ${}^{23}_{11}\text{Na} + {}^1_1\text{H} \rightarrow {}^{20}_{10}\text{Ne} + {}^4_2\text{He}$
 (c) ${}^{239}_{93}\text{Np} \rightarrow {}^{239}_{94}\text{Pu} + \beta^- + \bar{\nu}$
 (d) ${}^{11}_7\text{N} + {}^1_1\text{H} \rightarrow {}^{12}_6\text{C} + \beta^- + \bar{\nu}$.

30. When a guitar string is sounded with a 440 Hz tuning fork, a beat frequency of 5 Hz is heard. If the experiment is repeated with a tuning fork of 437 Hz, the beat frequency is 8 Hz. The string frequency (Hz) is

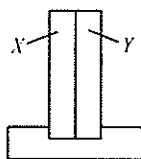
- (a) 445 (b) 435
 (c) 429 (d) 448.

31. A metallic ring is dropped down, keeping its plane perpendicular to a constant and horizontal magnetic field. The ring enters the region of magnetic field at $t = 0$ and completely emerges out at $t = T$ sec. The current in the ring varies as

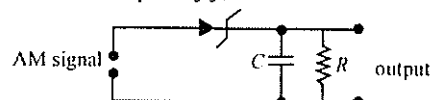


32. If alpha, beta and gamma rays carry same momentum, which has the longest wavelength

- (a) alpha rays (b) beta rays
(c) gamma rays
(d) none, all have same wavelength.
33. An amplifier has a voltage gain $A_V = 1000$. The voltage gain in dB is
(a) 30 dB (b) 60 dB
(c) 3 dB (d) 20 dB.
34. When you make ice cubes, the entropy of water
(a) does not change (b) increases
(c) decreases
(d) may either increase or decrease depending on the process used.
35. A bimetallic strip consists of metals X and Y . It is mounted rigidly at the base as shown. The metal X has a higher coefficient of expansion compared to that for metal Y . When the bimetallic strip is placed in a cold bath
(a) it will bend towards the right
(b) it will bend towards the left
(c) it will not bend but shrink
(d) it will neither bend or shrink.
36. For a wave propagating in a medium, identify the property that is independent of the others.
(a) velocity (b) wavelength
(c) frequency
(d) all these depend on each other.
37. A leaf which contains only green pigments is illuminated by a laser light of wavelength $0.6328 \mu\text{m}$. It would appear to be
(a) brown (b) black
(c) red (d) green.
38. A light emitting diode (LED) has a voltage drop of 2 volt across it and passes a current of 10 mA when it operates with a 6 volt battery through a limiting resistor R . The value of R is
(a) $40 \text{ k}\Omega$ (b) $4 \text{ k}\Omega$
(c) 200Ω (d) 400Ω .
39. The minimum potential difference between the base and emitter required to switch a silicon transistor ON is approximately
(a) 1 V (b) 3 V
(c) 5 V (d) 4.2 V.



40. Given below is the circuit diagram of an AM demodulator. For good demodulation of AM signal of carrier frequency f , the value of RC should be



- (a) $RC = 1/f$ (b) $RC < 1/f$
(c) $RC \geq 1/f$ (d) $RC \gg 1/f$.

Directions : In the following questions (41-60), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :

- (a) if both assertion and reason are true and reason is the correct explanation of the assertion
(b) if both assertion and reason are true but reason is not the correct explanation of the assertion
(c) if assertion is true, but reason is false
(d) both assertion and reason are false statements.
41. **Assertion :** Electromagnetic waves with frequencies smaller than the critical frequency of ionosphere cannot be used for communication using sky wave propagation.
Reason : The refractive index of the ionosphere becomes very high for frequencies higher than the critical frequency.
42. **Assertion :** The binding energy per nucleon, for nuclei with atomic mass number $A > 100$ decreases with A .
Reason : The nuclear forces are weak for heavier nuclei.
43. **Assertion :** In common base configuration, the current gain of the transistor is less than unity.
Reason : The collector terminal is reverse biased for amplification.
44. **Assertion :** In an isolated system the entropy increases.
Reason : The processes in an isolated system are adiabatic.
45. **Assertion :** Magnetic Resonance Imaging (MRI) is a useful diagnostic tool for producing images of various parts of human body.
Reason : Protons of various tissues of human body play a role in MRI.

46. **Assertion :** A judo fighter in order to throw his opponent on to the mat tries to initially bend his opponent and then rotate him around his hip.
Reason : As the mass of the opponent is brought closer to the fighter's hip, the force required to throw the opponent is reduced.
47. **Assertion :** The root mean square and most probable speeds of the molecules in a gas are the same.
Reason : The Maxwell distribution for the speed of molecules in a gas is symmetrical.
48. **Assertion :** Use of ball bearings between two moving parts of a machine is a common practice.
Reason : Ball bearings reduce vibrations and provide good stability.
49. **Assertion :** Standard optical diffraction gratings cannot be used for discriminating between different X-ray wavelengths.
Reason : The grating spacing is not of the order of X-ray wavelengths.
50. **Assertion :** Diamagnetic materials can exhibit magnetism.
Reason : Diamagnetic materials have permanent magnetic dipole moment.
51. **Assertion :** A man in a closed cabin which is falling freely does not experience gravity.
Reason : Inertial and gravitational mass have equivalence.
52. **Assertion:** The photoelectrons produced by a monochromatic light beam incident on a metal surface, have a spread in their kinetic energies.
Reason : The work function of the metal varies as a function of depth from the surface.
53. **Assertion :** The Carnot cycle is useful in understanding the performance of heat engines.
Reason : The Carnot cycle provides a way of determining the maximum possible efficiency achievable with reservoirs of given temperatures.
54. **Assertion :** A *p-n* junction with reverse bias can be used as a photo-diode to measure light intensity.
Reason : In a reverse bias condition the current is small but is more sensitive to changes in incident light intensity.
55. **Assertion :** Perspiration from human body helps in cooling the body.
Reason : A thin layer of water on the skin enhances its emissivity.
56. **Assertion :** When a glass of hot milk is placed in a room and allowed to cool, its entropy decreases.
Reason : Allowing hot object to cool does not violate the second law of thermodynamics.
57. **Assertion :** Cobalt-60 is useful in cancer therapy.
Reason : Cobalt-60 is a source of γ -radiations capable of killing cancerous cells.
58. **Assertion :** A thin stainless steel needle can lay floating on a still water surface.
Reason : Any object floats when the buoyancy force balances the weight of the object.
59. **Assertion :** An emf \vec{E} is induced in a closed loop where magnetic flux is varied. The induced \vec{E} is not a conservative field.
Reason : The line integral $\vec{E} \cdot d\vec{l}$ around the closed loop is non-zero.
60. **Assertion :** In optical fibre, the diameter of the core is kept small.
Reason : This smaller diameter of the core ensures that the fibre should have incident angle more than the critical angle required for total internal reflection.

CHEMISTRY

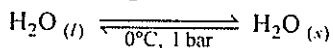
61. The pair in which both species have same magnetic moment (spin only value) is
 (a) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$, $[\text{CoCl}_4]^{2-}$
 (b) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 (c) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
 (d) $[\text{CoCl}_4]^{2-}$, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$.
62. The pair in which both species have iron is
 (a) nitrogenase, cytochromes
 (b) carboxypeptidase, haemoglobin
 (c) haemocyanin, nitrogenase
 (d) haemoglobin, cytochromes.
63. Borax is used as a cleansing agent because on dissolving in water it gives
 (a) alkaline solution (b) acidic solution
 (c) bleaching solution (d) basic solution.
64. The incorrect statement among the following is
 (a) C_{60} is an allotropic form of carbon

- (b) O_3 is an allotropic form of oxygen
 (c) S_8 is only allotropic form of sulphur
 (d) red phosphorus is more stable in air than white phosphorus.
65. The pair whose both species are used in anti-acid medicinal preparation is
 (a) $NaHCO_3$ and $Mg(OH)_2$
 (b) Na_2CO_3 and $Ca(HCO_3)_2$
 (c) $Ca(HCO_3)_2$ and $Mg(OH)_2$
 (d) $Ca(OH)_2$ and $NaHCO_3$.
66. The colour imparted by $Co(II)$ compounds to glass is
 (a) green (b) deep-blue
 (c) yellow (d) red.
67. The number of possible isomers of an octahedral complex $[Co(C_2O_4)_2(NH_3)_2]^-$ is
 (a) 1 (b) 2
 (c) 3 (d) 4.
68. The ligands in anti-cancer drug cisplatin are
 (a) NH_3 , Cl (b) NH_3 , H_2O
 (c) Cl , H_2O (d) NO , Cl .
69. Given below, catalyst and corresponding process/reaction are matched. The mismatch is
 (a) $[RhCl(PPh_3)_2]$: hydrogenation
 (b) $TiCl_4 + Al(C_2H_5)_3$: polymerization
 (c) V_2O_5 : Haber-Bosch process
 (d) nickel : hydrogenation.
70. Among the following, the species having square planar geometry for central atom are
 (i) XeF_4 , (ii) SF_4 , (iii) $[NiCl_4]^{2-}$, (iv) $[PdCl_4]^{2-}$
 (a) (i) and (iv) (b) (i) and (ii)
 (c) (ii) and (iii) (d) (iii) and (iv).
71. Tincture iodine is
 (a) aqueous solution of I_2
 (b) solution of I_2 in aqueous KI
 (c) alcoholic solution of I_2
 (d) aqueous solution of KI .
72. In $[Ag(CN)_2]^-$, the number of π bonds is
 (a) 2 (b) 3
 (c) 4 (d) 6.
73. The compound molecular in nature in gas phase but ionic in solid state is
 (a) PCl_5 (b) CCl_4
 (c) PCl_3 (d) $POCl_3$.
74. Which two of the following salts are used for preparing iodized salt?
 (i) KIO_3 , (ii) KI , (iii) I_2 , (iv) HI
 (a) (i) and (ii) (b) (i) and (iii)
 (c) (ii) and (iv) (d) (iii) and (iv).
75. The compound used in enrichment of uranium for nuclear power plant is
 (a) U_3O_8 (b) UF_6
 (c) $UO_2(NO_3)_2$ (d) UCl_4 .
76. The de Broglie wavelength associated with a ball of mass 1 kg having kinetic energy 0.5 J is
 (a) 6.626×10^{-34} m (b) 13.20×10^{-34} m
 (c) 10.38×10^{-21} m (d) 6.626×10^{-34} Å.
77. Dominance of strong repulsive forces among the molecules of the gas (Z = compressibility factor)
 (a) depends on Z and indicated by $Z = 1$
 (b) depends on Z and indicated by $Z > 1$
 (c) depends on Z and indicated by $Z < 1$
 (d) is independent of Z .
78. 40 ml of 0.1 M ammonia solution is mixed with 20 ml of 0.1 M HCl . What is the pH of the mixture? (pK_b of ammonia solution is 4.74)
 (a) 4.74 (b) 2.26
 (c) 9.26 (d) 5.00
79. For a spontaneous process the correct statement is
 (a) entropy of the system always increases
 (b) free energy of the system always increases
 (c) total entropy change is always negative
 (d) total entropy change is always positive.
80. The Ca^{2+} and F^- are located in CaF_2 crystal, respectively at face centred cubic lattice points and in
 (a) tetrahedral voids
 (b) half of tetrahedral voids
 (c) octahedral voids
 (d) half of octahedral voids.
81. The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is
 (a) 1 F (b) 3 F
 (c) 5 F (d) 6 F.
82. For the reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$

rate of reaction is

- (a) $\frac{1}{2} \frac{d}{dt} [\text{N}_2\text{O}_5]$ (b) $2 \frac{d}{dt} [\text{N}_2\text{O}_5]$
 (c) $\frac{1}{4} \frac{d}{dt} [\text{NO}_2]$ (d) $4 \frac{d}{dt} [\text{NO}_2]$

83. For a phase change



- (a) $\Delta G = 0$ (b) $\Delta S = 0$
 (c) $\Delta H = 0$ (d) $\Delta U = 0$

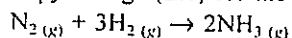
84. A 5% solution (by mass) of cane sugar in water has freezing point of 271 K and freezing point of pure water is 273.15 K. The freezing point of a 5% solution (by mass) of glucose in water is

- (a) 271 K (b) 273.15 K
 (c) 269.07 K (d) 277.23 K

85. The energy gaps (E_g) between valence band and conduction band for diamond, silicon and germanium are in the order

- (a) $E_g(\text{diamond}) > E_g(\text{silicon}) > E_g(\text{germanium})$
 (b) $E_g(\text{diamond}) < E_g(\text{silicon}) < E_g(\text{germanium})$
 (c) $E_g(\text{diamond}) = E_g(\text{silicon}) = E_g(\text{germanium})$
 (d) $E_g(\text{diamond}) > E_g(\text{germanium}) > E_g(\text{silicon})$

86. The enthalpy change (ΔH) for the reaction,



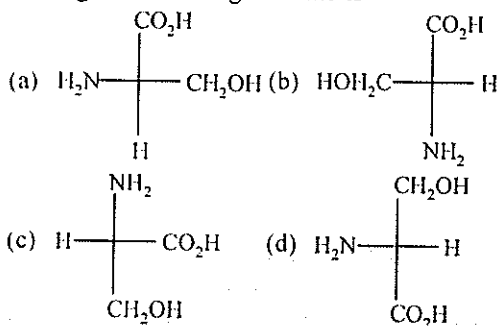
is -92.38 kJ at 298 K. The internal energy change ΔU at 298 K is

- (a) -92.38 kJ (b) -87.42 kJ
 (c) -97.34 kJ (d) -89.9 kJ

87. The products formed when an aqueous solution of NaBr is electrolysed in a cell having inert electrodes are

- (a) Na and Br_2 (b) Na and O_2
 (c) H_2 , Br_2 and NaOH (d) H_2 and O_2

88. Among the following L-serine is



89. Among the following which one can have a meso form?

- (a) $\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{Cl})\text{C}_2\text{H}_5$
 (b) $\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$
 (c) $\text{C}_2\text{H}_5\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$
 (d) $\text{HOCH}_2\text{CH}(\text{Cl})\text{CH}_3$

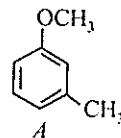
90. Which of the following sequence of reactions (reagents) can be used for the conversion of $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_3$ into $\text{C}_6\text{H}_5\text{CH}=\text{CH}_2$?

- (a) SOCl_2 ; H_2O (b) SO_2Cl_2 ; alc. KOH
 (c) Cl_2/hv ; H_2O (d) SOCl_2 ; alc. KOH

91. Isopropyl benzene on air oxidation in the presence of dilute acid gives

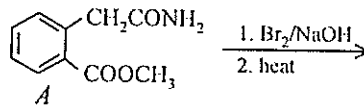
- (a) $\text{C}_6\text{H}_5\text{COOH}$ (b) $\text{C}_6\text{H}_5\text{COCH}_3$
 (c) $\text{C}_6\text{H}_5\text{CHO}$ (d) $\text{C}_6\text{H}_5\text{OH}$

92. The major product obtained on the monobromination (with $\text{Br}_2/\text{FeBr}_3$) of the following compound A is



- (a) (b)
 (c) (d)

93. The following sequence of reactions on A gives



- (a) (b)
 (c) (d)

94. Nitrobenzene on treatment with zinc dust and aqueous ammonium chloride gives
 (a) $C_6H_5N \equiv N - C_6H_5$
 (b) $C_6H_5NH_2$
 (c) C_6H_5NO (d) C_6H_5NHOH .
95. Thymine is
 (a) 5-methyluracil (b) 4-methyluracil
 (c) 3-methyluracil (d) 1-methyluracil.
96. Lysine is least soluble in water in the pH range
 (a) 3 to 4 (b) 5 to 6
 (c) 6 to 7 (d) 8 to 9.
97. Methyl- α -D-glucoside and methyl- β -D-glucoside are
 (a) epimers (b) anomers
 (c) enantiomers
 (d) conformational diastereomers.
98. Which of the following compounds has the highest boiling point?
 (a) $CH_3CH_2CH_2Cl$ (b) $CH_3CH_2CH_2CH_2Cl$
 (c) $CH_3CH(CH_3)CH_2Cl$ (d) $(CH_3)_3CCl$.
99. The correct increasing order of the reactivity of halides for S_N1 reaction is
 (a) $CH_3 - CH_2 - X < (CH_3)_2CH - X < CH_2 = CH - CH_2 - X < PhCH_2 - X$
 (b) $(CH_3)_2CH - X < CH_3 - CH_2 - X < CH_2 = CH - CH_2 - X < PhCH_2 - X$
 (c) $PhCH_2 - X < (CH_3)_2CH - X < CH_3 - CH_2 - X < CH_2 = CH - CH_2 - X$
 (d) $CH_2 = CH - CH_2 - X < Ph - CH_2 - X < (CH_3)_2CH - X < CH_3 - CH_2 - X$.
100. The major product formed in the following reaction is

$$CH_3CH(Cl)CH_2 - CH_2OH \xrightarrow{aq. KOH}$$

 (a) $CH_3CH = CH - CH_2OH$
 (b) $CH_2 = CH - CH_2 - CH_2OH$
 (c) $CH_3 - \underset{\substack{| \\ O - CH_2}}{CH} - CH_2$
 (d) $CH_3 - \underset{\substack{| \\ OH}}{CH} - CH_2 - CH_2OH$
- Directions :** In the following questions (101-120), a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as :
- (a) if both assertion and reason are true and reason is the correct explanation of the assertion
 (b) if both assertion and reason are true but reason is not the correct explanation of the assertion
 (c) if assertion is true, but reason is false
 (d) both assertion and reason are false statements.
101. **Assertion :** In the iodometric titration starch is used as an indicator.
Reason : Starch is a polysaccharide.
102. **Assertion :** Molecular nitrogen is less reactive than molecular oxygen.
Reason : The bond length of N_2 is shorter than that of oxygen.
103. **Assertion :** $[Co(NO_2)_3(NH_3)_3]$ does not show optical isomerism.
Reason : It has a plane of symmetry.
104. **Assertion :** E° for Mn^{3+}/Mn^{2+} is more positive than Cr^{3+}/Cr^{2+} .
Reason : The third ionization energy of Mn is larger than that of Cr.
105. **Assertion :** $K_2Cr_2O_7$ is used as primary standard in volumetric analysis.
Reason : It has a good solubility in water.
106. **Assertion :** Silicones are hydrophobic in nature.
Reason : Si-O-Si linkages are moisture sensitive.
107. **Assertion :** According to transition state theory, for the formation of an activated complex, one of the vibrational degrees of freedom is converted into a translational degree of freedom.
Reason : Energy of the activated complex is higher than the energy of reactant molecules.
108. **Assertion :** Water in liquid state is more stable than ice at room temperature.
Reason : Water in liquid form has higher entropy than ice.
109. **Assertion :** Sb_2S_3 is not soluble in yellow ammonium sulphide.
Reason : The common ion effect due to S^{2-} ions reduces the solubility of Sb_2S_3 .
110. **Assertion :** Graphite is an example of tetragonal crystal system.
Reason : For a tetragonal system, $a = b \neq c$, $\alpha = \beta = 90^\circ$, $\gamma = 120^\circ$.
111. **Assertion :** For the Daniel cell, $Zn|Zn^{2+}||Cu^{2+}|Cu$ with $E_{cell} = 1.1$ V, the application of opposite potential greater than 1.1 V results into flow of

electron from cathode to anode.

Reason : Zn is deposited at anode and Cu is dissolved at cathode.

112. **Assertion :** Fe^{3+} can be used for coagulation of As_2S_3 sol.

Reason : Fe^{3+} reacts with As_2S_3 to give Fe_2S_3 .

113. **Assertion :** If red blood cells were removed from the body and placed in pure water, pressure inside the cells increases.

Reason : The concentration of salt content in the cells increases.

114. **Assertion :** Change in colour of acidic solution of potassium dichromate by breath is used to test drunk drivers.

Reason : Change in colour is due to the complexation of alcohol with potassium dichromate.

115. **Assertion :** Anilinium chloride is more acidic than ammonium chloride.

Reason : Anilinium ion is resonance-stabilised.

116. **Assertion :** Diastereomers have different physical properties.

Reason : They are non-superimposable mirror images.

117. **Assertion :** The presence of nitro group facilitates nucleophilic substitution reactions in aryl halides.

Reason : The intermediate carbanion is stabilised due to the presence of nitro group.

118. **Assertion :** 1,3-butadiene is the monomer for natural rubber.

Reason : Natural rubber is formed through anionic addition polymerization.

119. **Assertion :** Addition of HBr on 2-butene gives two isomeric products.

Reason : Addition of HBr on 2-butene follows Markovnikov's rule.

120. **Assertion :** The water pouch of instant cold pack for treating athletic injuries breaks when squeezed and NH_4NO_3 dissolves lowering the temperature.
Reason : Addition of non-volatile solute into solvent results into depression of freezing point of solvent.

BIOLOGY

121. Given below is a table comparing the effects of sympathetic and parasympathetic nervous system

for four feature (1–4). Which one feature is correctly described ?

Feature	Sympathetic nervous system	Parasympathetic nervous system
(a) salivary glands	stimulates secretion	inhibits secretion
(b) pupil of the eye	dilate	constricts
(c) heart rate	decreases	increases
(d) intestinal peristalsis	stimulates	inhibits

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

Animal	Characteristic	Taxon
(a) millipede	ventral nerve cord	arachnida
(b) duckbill platypus	oviparous	mammalia
(c) silverfish	pectoral & pelvic fins	chordata
(d) sea anemone	triploblastic	cnidaria

123. All mammals without any exception are characterized by

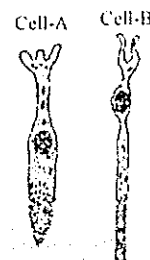
- (a) viviparity and biconcave red blood cells
- (b) extra-abdominal testes and a four chambered heart
- (c) heterodont teeth and 12 pairs of cranial nerves
- (d) a muscular diaphragm and milk producing glands

124. Which one of the following pairs of the kind of cells and their secretion is correctly matched ?

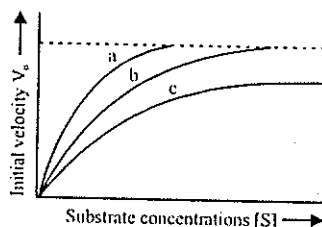
- (a) oxyntic cells — a secretion with pH between 2.0 and 3.0
- (b) alpha cells of islets of Langerhans — secretion that decreases blood sugar level
- (c) Kupffer cells — a digestive enzyme that hydrolyses nucleic acids
- (d) sebaceous glands — a secretion that evaporates for cooling

125. Examine the diagram of the two cell types A and B given below and select the correct option

- (a) cell A is the rod cell found evenly all over retina
- (b) cell A is the cone cell more concentrated in the fovea centralis



- (c) cell B is concerned with colour vision in bright light
(d) cell A is sensitive to low light intensities
126. Which one of the following pairs of features is a good example of polygenic inheritance?
(a) human height and skin colour
(b) ABO blood group in humans and flower colour of *Mirabilis jalapa*
(c) hair pigment of mouse and tongue rolling in humans
(d) human eye colour and sickle cell anaemia
127. Mating of an organism to a double recessive in order to determine whether it is homozygous or heterozygous for a character under consideration is called
(a) reciprocal cross (b) test cross
(c) dihybrid cross (d) back cross
128. In which one of the following sets of three items each belong to the category mentioned against them?
(a) lysine, glycine, thiamine — amino acids
(b) myosin, oxytocin and gastrin — hormones
(c) rennin, helicase and hyaluronidase — enzymes
(d) optic nerve, oculomotor, vagus — sensory nerves
129. A cricket player is fast chasing a ball in the field. Which one of the following groups of bones are **directly** contributing in this movement?
(a) femur, malleus, tibia, metatarsals
(b) pelvis, ulna, patella, tarsals
(c) sternum, femur, tibia, fibula
(d) tarsals, femur, metatarsals, tibia
130. Given below is a highly simplified representation of the human sex chromosomes from a karyotype.
The gene *a* and *b* could be of
(a) colour blindness and body height
(b) attached ear lobe and Rhesus blood group
(c) haemophilia and red-green colour blindness
(d) phenylketonuria and haemophilia
131. A lizard-like member of reptilia is sitting on a tree with its tail coiled around a twig. This animal could be
(a) *Hemidactylus* showing sexual dimorphism
(b) *Varanus* showing mimicry
(c) garden lizard (*Calotes*) showing camouflage
(d) *Chamaeleon* showing protective colouration
132. The figure given below shows three velocity-substrate concentration curves for an enzyme reaction. What do the curves a, b, and c depict respectively?



- (a) a-normal enzyme reaction, b-competitive inhibition, c-non-competitive inhibition
(b) a-enzyme with an allosteric modulator added, b-normal enzyme activity, c-competitive inhibition
(c) a-enzyme with an allosteric stimulator, b-competitive inhibition added, c-normal enzyme reaction
(d) a-normal enzyme reaction, b-non-competitive inhibitor added, c-allosteric inhibitor added
133. Pollution from animal excreta and organic waste from kitchen can be most profitably minimized by
(a) storing them in underground storage tanks
(b) using them for producing biogas
(c) vermiculture
(d) using them directly as biofertilizers
134. A person who shows unpredictable moods, outbursts of emotion, quarrelsome behaviour and conflicts with others is suffering from
(a) borderline personality disorder (BPD)
(b) mood disorder
(c) addictive disorder (d) schizophrenia
135. Genes present in the cytoplasm of eukaryotic cells are found in
(a) mitochondria and inherited *via* egg cytoplasm
(b) lysosomes and peroxisomes
(c) golgi bodies and smooth endoplasmic reticulum
(d) plastids and inherited *via* male gamete
136. The type of epithelial cells which line the inner surface of fallopian tubes, bronchioles and small bronchi are known as

- (a) squamous epithelium
- (b) columnar epithelium
- (c) ciliated epithelium
- (d) cubical epithelium

137. Tadpoles of frog can be made to grow as giant sized tadpoles, if they are

- (a) administered antithyroid substance like thiourea
- (b) administered large amounts of thyroxine
- (c) reared on a diet rich in egg yolk
- (d) reared on a diet rich in both egg yolk and glucose

138. When children play bare footed in pools of dirty water and flood water, they may suffer from disease like

- (a) leptospirosis and bilharzia
- (b) malaria, amoebic dysentery and leptospirosis
- (c) bilharzia, infective hepatitis and diarrhoea
- (d) guinea worm infection, elephantiasis and amoebic dysentery

139. Which one of the following is an environment-related disorder with the correct main cause?

- (a) black lung disease (pneumoconiosis) found mainly in workers in stone quarries and crushers
- (b) blue baby disease (methaemoglobinaemia) due to heavy use of nitrogenous fertilizers in the area
- (c) Non-hodgkin's lymphoma found mainly in workers involved in manufacture of neem based pesticides
- (d) skin cancer mainly in people exposed to benzene and methane

140. The given figure shows an angiogram of the coronary blood vessel. Which one of the following statements correctly describes, what is being done?



- (a) it is coronary artery which has a cancerous growth that is being removed
- (b) it is coronary artery which is blocked by a plaque and the same is being cracked
- (c) it is coronary vein in which the defective valves are being opened
- (d) it is coronary vein blocked by a parasite (blood fluke) that is being removed

141. In the following table identify the correct matching of the crop, its disease and the corresponding pathogen.

Crop	Disease	Pathogen
(a) citrus	canker	<i>Pseudomonas rubrilineans</i>
(b) potato	late blight	<i>Fusarium udum</i>
(c) brinjal	root-knot	<i>Meloidogyne incognita</i>
(d) pigeon pea	seed gall	<i>Phytophthora infestans</i>

142. In which one of the following combinations (a-d) of the number of chromosomes is the present day hexaploid wheat correctly represented?

Combination	Mono-somic	Haploid	Nullisomic	Trisomic
(a)	21	28	42	43
(b)	7	28	40	42
(c)	21	7	42	43
(d)	41	21	40	43

143. Grafting is successful in dicots but not in monocots because the dicots have

- (a) vascular bundles arranged in a ring
- (b) cambium for secondary growth
- (c) vessels with elements arranged end to end
- (d) cork cambium

144. In the sieve elements, which one of the following is the most likely function of P-proteins?

- (a) deposition of callose on sieve plates
- (b) providing energy for active translocation
- (c) autolytic enzymes
- (d) sealing mechanism on wounding

145. Myxomycetes are

- (a) saprobes or parasites, having mycelia, asexual reproduction by fragmentation, sexual reproduction by fusion of gametes
- (b) slimy mass of multinucleate protoplasm, having pseudopodia-like structures for engulfing food, reproduction through fragmentation or zoospores
- (c) prokaryotic organisms, cellular or acellular, saprobes or autotrophic, reproduce by binary fission
- (d) eukaryotic, single-celled or filamentous, saprobes or autotrophic, asexual reproduction by fusion of two cells or their nuclei

146. "Ordines Anomali" of Bentham and Hooker includes

- (a) seed plants showing abnormal forms of growth and development
 (b) plants described only in fossil state
 (c) plants described in the literature but which Bentham and Hooker did not see in original
 (d) a few orders which could not be placed satisfactorily in the classification
147. Hirudin is
 (a) a protein produced by *Hordeum vulgare*, which is rich in lysine
 (b) a toxic molecule isolated from *Gossypium hirsutum*, which reduces human fertility
 (c) a protein produced from transgenic *Brassica napus*, which prevents blood clotting
 (d) an antibiotic produced by a genetically engineered bacterium, *Escherichia coli*
148. A scion is grafted to a stock. The quality of fruits produced will be determined by the genotype of
 (a) stock
 (b) scion
 (c) both stock and scion
 (d) neither stock nor scion
149. In prokaryotes, chromatophores are
 (a) specialized granules responsible for colouration of cells
 (b) structures responsible for organizing the shape of the organism
 (c) inclusion bodies lying free inside the cells for carrying out various metabolic activities
 (d) internal membrane systems that may become extensive and complex in photosynthetic bacteria
150. Among rust, smut and mushroom all the three
 (a) are pathogens (b) are saprobes
 (c) bear ascocarps (d) bear basidiocarps
151. The function of leghaemoglobin during biological nitrogen fixation in root nodules of legumes is to
 (a) convert atmospheric N_2 to NH_3
 (b) convert ammonia to nitrite
 (c) transport oxygen for activity of nitrogenase
 (d) protect nitrogenase from oxygen
152. *Avena* curvature test is a bioassay for examining the activity of
 (a) auxins (b) gibberellins
 (c) cytokinins (d) ethylene
153. What is common between chloroplasts, chromoplasts and leucoplasts?
 (a) presence of pigments
 (b) possession of thylakoids and grana
 (c) storage of starch, proteins and lipids
 (d) ability to multiply by a fission-like process
154. Plants of which one of the following groups of genera are pollinated by the same agency?
 (a) *Triticum*, *Cocos*, *Mangifera*
 (b) *Ficus*, *Kigelia*, *Casuarina*
 (c) *Salvia*, *Morus*, *Euphorbia*
 (d) *Bombax*, *Butea*, *Bauhinia*
155. The Montreal Protocol refers to
 (a) persistent organic pollutants
 (b) global warming and climate change
 (c) substances that deplete the ozone layer
 (d) biosafety of genetically modified organisms
156. Keystone species deserve protection because these
 (a) are capable of surviving in harsh environmental conditions
 (b) indicate presence of certain minerals in the soil
 (c) have become rare due to overexploitation
 (d) play an important role in supporting other species
157. In India, we find mangoes with different flavours, colours, fibre content, sugar content and even shelf-life. The large variation is on account of
 (a) species diversity (b) induced mutations
 (c) genetic diversity (d) hybridization
158. During protein synthesis in an organism at one point the process comes to a halt. Select the group of the three codons from the following, from which any one of the three could bring about this halt.
 (a) UUU, UCC, UAU (b) UUC, UUA, UAC
 (c) UAG, UGA, UAA (d) UUG, UCA, UCG
159. Biosphere reserves differ from National Parks and Wildlife sanctuaries because in the former
 (a) human beings are not allowed to enter
 (b) people are an integral part of the system
 (c) plants are paid greater attention than the animals
 (d) living organisms are brought from all over the world and preserved for posterity
160. Somaclonal variation is seen in
 (a) tissue culture grown plants
 (b) apomicts (c) polyploids
 (d) vegetatively propagated plants

Direction : In the following questions (161–180), a statement of assertion is given and a corresponding statement of reason is given just below it. Of the statements, mark the correct answer as -

- (a) *If both Assertion & Reason are true and the reason is the correct explanation of the assertion.*
 - (b) *If both Assertion & Reason are true but the reason is not the correct explanation of the assertion.*
 - (c) *If Assertion is true statement but Reason is false.*
 - (d) *If both Assertion and Reason are false statements.*
161. **Assertion :** A person who has received a cut and is bleeding needs to be given anti-tetanus treatment.
Reason : Anti-tetanus injection provides immunity by producing antibodies for tetanus.
 162. **Assertion :** Cancer cells are virtually immortal until the body in which they reside dies.
Reason : Cancer is caused by damage to genes regulating the cell division cycle.
 163. **Assertion :** A network of food chains existing together in an ecosystem is known as a food web.
Reason : An animal like kite cannot be a part of a food web.
 164. **Assertion :** Inflammation of a skeletal joint may immobilize the movements of the joint.
Reason : Uric acid crystals in the joint cavity and ossification of articular cartilage lead to this.
 165. **Assertion :** The earliest organisms that appeared on the Earth were non-green and presumably anaerobes.
Reason : The first autotrophic organisms were the chemoautotrophs that never released oxygen.
 166. **Assertion :** *Escherichia coli*, *Shigella* sp. and *Salmonella* sp. are all responsible for diarrhoeal disease.
Reason : Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids electrolytes should be ensured.
 167. **Assertion :** Deforestation is one main factor contributing to global warming.
Reason : Besides CO₂, two other gases methane and CFCs are also included under green house gases.
 168. **Assertion :** LSD and marijuana are clinically used as analgesics.
Reason : Both these drugs suppress brain function.
 169. **Assertion :** An organism with lethal mutation may not even develop beyond the zygote stage.
Reason : All types of gene mutations are lethal.
 170. **Assertion :** Our body secretes adrenaline in intense cold.
Reason : Adrenaline raises metabolic rate.
 171. **Assertion :** When the ambient temperature is high and soil contains excess of water, the plants tend to lose water in the form of droplets from lenticels.
Reason : Root pressure regulates the rate of loss of water from lenticels.
 172. **Assertion :** In angiosperms the conduction of water is more efficient because their xylem has vessels.
Reason : Conduction of water by vessel elements is an active process with energy supplied by xylem parenchyma rich in mitochondria.
 173. **Assertion :** Polytene chromosomes have a high amount of DNA.
Reason : Polytene chromosomes are formed by repeated replication of chromosomal DNA without separation of chromatids.
 174. **Assertion :** UV radiation causes photodissociation of ozone into O₂ and O, thus causing damage to the stratospheric ozone layer.
Reason : Ozone hole is resulting in global warming and climate change.
 175. **Assertion :** The concentration of methane in the atmosphere has more than doubled in the last 250 years.
Reason : Wetlands and rice fields are the major sources of methane.
 176. **Assertion :** In tropical rain forests, O-horizon and A-horizon of soil profile are shallow and nutrient-poor.
Reason : Excessive growth of micro-organisms in the soil depletes its organic content.
 177. **Assertion :** Gram-negative bacteria do not retain the stain when washed with alcohol.
Reason : The outer face of the outer membrane of Gram-negative bacteria contains lipopolysaccharides, a part of which is integrated into the membrane lipids.

178. **Assertion :** Under conditions of high light intensity and limited CO_2 supply, photorespiration has a useful role in protecting the plants from photo-oxidative damage.
Reason : If enough CO_2 is not available to utilize light energy for carboxylation to proceed, the excess energy may not cause damage to plants.
179. **Assertion :** Photosynthetically C_4 plants are less efficient than C_3 plants.
Reason : The operation of C_4 pathway requires the involvement of only bundle-sheath cells.
180. **Assertion :** Eukaryotic cells have the ability to adopt a variety of shapes and carry out directed movements.
Reason : There are three principal types of protein filaments - microfilaments, microtubules and intermediate filaments, which constitute the cytoskeleton.

GENERAL KNOWLEDGE

181. The term 'CPR' often used in first aid stands for
 (a) Clinic for Pulmonary Rehabilitation
 (b) Chemical Prevention of Rhinitis
 (c) Chemo-Prophylaxis response
 (d) Cardio-Pulmonary resuscitation
182. Alzheimer's disease affects
 (a) childhood (b) adolescent
 (c) young people (d) elderly people
183. Central Council for Research in Yoga and Naturopathy (CCRYN) is an organization that funds research in the given field in our country. It is located in
 (a) New Delhi (b) Rishikesh
 (c) Bangalore (d) Hyderabad
184. The vaccination for which one of the following diseases is not covered in the immunization schedule so far?
 (a) tuberculosis (b) diphtheria
 (c) measles (d) pneumonia
185. Which one of the following is true and is not a misconception?
 (a) cutting the top of a bitter cucumber and rubbing it with the corresponding surface removes bitterness
 (b) pearl is produced from a drop of rain water falling into the oyster in Swati Nakshatra
 (c) while dreaming during sleep at night the eyes move rapidly
 (d) peahen gets conceived from the tears that drop from the peacock's eye and she drinks them
186. A drug called reserpine was discovered by
 (a) Jal Vakil (b) Paul Ehrlich
 (c) Hansen (d) Alexander Wood
187. Biometry refers to
 (a) identification of humans by scanning face and fingerprints
 (b) measurement of mechanical displacement in humans
 (c) a method of lie detection
 (d) body length relationships across the evolutionary scale
188. Which one of the following is one of the two days when the sun rises exactly in the east?
 (a) 14th January (b) 21st March
 (c) 21st June (d) 23rd December
189. X-rays were discovered by
 (a) Wilhelm K. Roentgen
 (b) H. Kissinger
 (c) Sir C.V. Raman (d) Meghnad Saha
190. Which one of the following literary titles is correctly matched with its author?
 (a) Ramayana - Tulsidas
 (b) Mahabharat - Vedvyas
 (c) Kumarsambhav - Ravidas
 (d) Shakuntala - Bhushan
191. A very much publicized treatment method "DOTS" is being adopted for the cure of
 (a) dementia (b) tetanus
 (c) tuberculosis
 (d) sexually transmitted disease
192. Which of the following Indian cricket player after India-Pakistan ODI (One-day International) at Abudhabi became no.1 ODI batsman in the ICC (International Cricket Club) ranking
 (a) Rahul Dravid (b) Yuvraj
 (c) Sachin Tendulkar (d) M.S. Dhoni
193. The Jungle in Rudyard Kipling's Jungle book, describes which part of Indian forest?
 (a) central Indian forest near Satpura range
 (b) Uttaranchal thick forest
 (c) Himalayan forest in Himachal
 (d) Nilgiri jungles

194. Sardar Sarovar Dam is built on the river
(a) Jhelam (b) Narmada
(c) Tapti (d) Vyas
195. One ream of paper equals to
(a) 100-110 sheets (b) 256 sheets
(c) 480-500 sheets (d) 1000 sheets
196. Which of the following honour is given by UNESCO ?
(a) the Kalinga prize
(b) Magasay award
(c) Pulitzer prize
(d) order of the Golden Ark award
197. 'Body line' in cricket refers to
(a) bowling that hits the body
(b) the line of body close to wicket line
(c) the white line on ground within which the player stands
(d) the line of moving ball
198. 'Hindu view of life' is written by
(a) S. Radhakrishnan (b) R.K. Narayan
(c) V.D. Savarkar (d) John Ruskin
199. Lagoon refers to
(a) a full moon
(b) the sea breaking into the land and then separated by sand dunes
(c) a spot in a desert made fertile by presence of water
(d) horse shoe shaped coral reef
200. Ecology deals with
(a) the earth and planets
(b) the relationship between organism and their environments
(c) the life under the sea
(d) economical growth of poor people