

# SOLVED PAPER

## AIIMS - 2003

Time : 3½ Hours

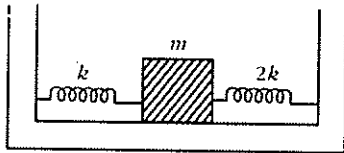
Max. Marks : 200

### PHYSICS

1. The velocity with which a projectile must be fired so that it escapes earth's gravitation does not depend on
  - (a) mass of the earth
  - (b) mass of the projectile
  - (c) radius of the projectile's orbit
  - (d) gravitational constant.
2. Bernoulli's equation is a consequence of conservation of
  - (a) energy
  - (b) linear momentum
  - (c) angular momentum
  - (d) mass.
3. A laser beam is used for carrying out surgery because it
  - (a) is highly monochromatic
  - (b) is highly coherent
  - (c) is highly directional
  - (d) can be sharply focussed.
4. A wire of length  $L$  is drawn such that its diameter is reduced to half of its original diameter. If the initial resistance of the wire were  $10\ \Omega$ , its new resistance would be
  - (a)  $40\ \Omega$
  - (b)  $80\ \Omega$
  - (c)  $120\ \Omega$
  - (d)  $160\ \Omega$ .
5. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference of 1 kV, its kinetic energy will be
  - (a) 1840 keV
  - (b)  $1/1840$  keV
  - (c) 1 keV
  - (d) 920 keV.
6. An electric dipole placed in a non-uniform electric field experiences
  - (a) both a torque and a net force
  - (b) only a force but no torque
  - (c) only a torque but no net force
  - (d) no torque and no net force.
7. In an ideal parallel LC circuit, the capacitor is charged by connecting it to a d.c. source which is then disconnected. The current in the circuit
  - (a) becomes zero instantaneously
  - (b) grows monotonically
  - (c) decays monotonically
  - (d) oscillates instantaneously.
8. To a germanium sample, traces of gallium are added as an impurity. The resultant sample would behave like
  - (a) a conductor
  - (b) a  $p$ -type semiconductor
  - (c) an  $n$ -type semiconductor
  - (d) an insulator.
9. A radioactive substance decays to  $1/16^{\text{th}}$  of its initial activity in 40 days. The half-life of the radioactive substance expressed in days is
  - (a) 2.5
  - (b) 5
  - (c) 10
  - (d) 20.
10. A neutron makes a head-on elastic collision with a stationary deuteron. The fractional energy loss of the neutron in the collision is
  - (a)  $16/81$
  - (b)  $8/9$
  - (c)  $8/27$
  - (d)  $2/3$ .
11. The motion of planets in the solar system is an example of the conservation of
  - (a) mass
  - (b) linear momentum
  - (c) angular momentum
  - (d) energy.
12. Two small drops of mercury, each of radius  $R$ , coalesce to form a single large drop. The ratio of the total surface energies before and after the change is
  - (a)  $1 : 2^{1/3}$
  - (b)  $2^{1/3} : 1$
  - (c)  $2 : 1$
  - (d)  $1 : 2$ .
13. A black body, at a temperature of  $227^\circ\text{C}$ , radiates heat at a rate of  $20\ \text{cal m}^{-2}\text{s}^{-1}$ . When its temperature is raised to  $727^\circ\text{C}$ , the heat radiated by it in  $\text{cal m}^{-2}\text{s}^{-1}$  will be closest to

- (a) 40 (b) 160  
(c) 320 (d) 640

14. Two springs of force constants  $k$  and  $2k$  are connected to a mass as shown in figure. The frequency of oscillation of the mass is



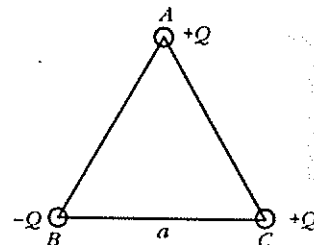
- (a)  $\frac{1}{2\pi} \sqrt{\frac{k}{m}}$  (b)  $\frac{1}{2\pi} \sqrt{\frac{2k}{m}}$   
(c)  $\frac{1}{2\pi} \sqrt{\frac{3k}{m}}$  (d)  $\frac{1}{2\pi} \sqrt{\frac{m}{k}}$
15. When a beam of light is used to determine the position of an object, the maximum accuracy is achieved if the light is  
(a) polarised (b) of longer wavelength  
(c) of shorter wavelength (d) of high intensity.
16. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness  $2 \mu\text{m}$  and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will  
(a) remain unshifted  
(b) shift downward by nearly two fringes  
(c) shift upward by nearly two fringes  
(d) shift downward by 10 fringes.
17. If an electron and a photon propagate in the form of waves having the same wavelength, it implies that they have the same  
(a) energy (b) momentum  
(c) velocity (d) angular momentum.
18. Characteristic X-rays are produced due to  
(a) transfer of momentum in collision of electrons with target atoms  
(b) transition of electron from higher to lower electrons orbits in an atom  
(c) heating of the target  
(d) transfer of energy in collision of electrons with atoms in the target.
19. Three charges are placed at the vertices of an equilateral triangle of side  $a$  as shown in the given figure. The force experienced by the charge placed at the vertex  $A$  in a direction normal to  $BC$  is

(a)  $\frac{Q^2}{4\pi\epsilon_0 a^2}$

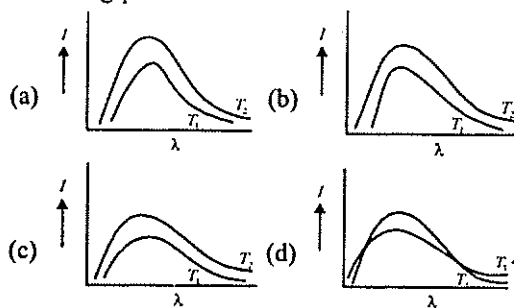
(b)  $-Q^2 (4\pi\epsilon_0 a^2)$

(c) zero

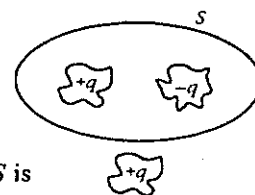
(d)  $\frac{Q^2}{2\pi\epsilon_0 a^2}$



20. A capacitor of capacitance  $2 \mu\text{F}$  is connected in the tank circuit of an oscillator oscillating with a frequency of 1 kHz. If the current flowing in the circuit is 2 mA, the voltage across the capacitor will be  
(a) 0.16 V (b) 0.32 V  
(c) 79.5 V (d) 159 V.
21. The earth's magnetic field at a given point is  $0.5 \times 10^{-5} \text{ Wb/m}^2$ . This field is to be annulled by magnetic induction at the center of a circular conducting loop of radius 5.0 cm. The current required to be flown in the loop is nearly  
(a) 0.2 A (b) 0.4 A  
(c) 4 A (d) 40 A.
22. A frog can be levitated in a magnetic field produced by a current in a vertical solenoid placed below the frog. This is possible because the body of the frog behaves as  
(a) paramagnetic (b) diamagnetic  
(c) ferromagnetic (d) antiferromagnetic.
23. Shown below are the black body radiation curves at temperatures  $T_1$  and  $T_2$  ( $T_2 > T_1$ ). Which of the following plots is correct?

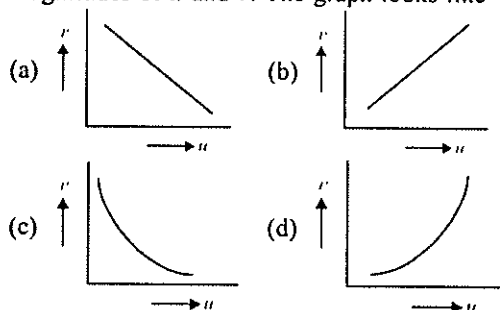


24. Figure shown is a distribution of charges. The flux of electric field due to these charges through the surface  $S$  is

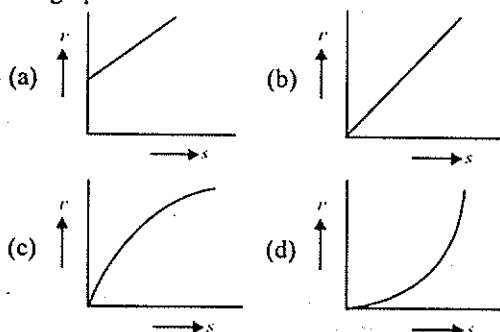


- (a)  $3q/\epsilon_0$  (b)  $2q/\epsilon_0$   
(c)  $q/\epsilon_0$  (d) zero.

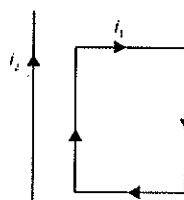
25. In an experiment to find the focal length of a concave mirror a graph is drawn between the magnitudes of  $u$  and  $v$ . The graph looks like



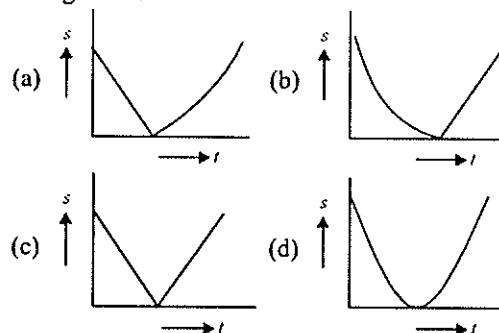
26. Nuclear fusion is possible  
(a) only between light nuclei  
(b) only between heavy nuclei  
(c) between both light and heavy nuclei  
(d) only between nuclei which are stable against  $\beta$ -decay.
27. An electron is travelling along the  $x$ -direction. It encounters a magnetic field in the  $y$ -direction. Its subsequent motion will be  
(a) straight line along the  $x$ -direction  
(b) a circle in the  $xz$  plane  
(c) a circle in the  $yz$  plane  
(d) a circle in the  $xy$  plane.
28. The difference in lengths of a mean solar day and a sidereal day is about  
(a) 1 min (b) 4 min  
(c) 15 min (d) 56 min.
29. A body starting from rest moves along a straight line with a constant acceleration. The variation of speed ( $v$ ) with distance ( $s$ ) is represented by the graph



30. A rectangular loop carrying a current  $i_1$ , is situated near a long straight wire carrying a steady current  $i_2$ . The wire is parallel to one of the sides of the loop and is in the plane of the loop as shown in the figure. Then the current loop will



- (a) move away from the wire  
(b) move towards the wire  
(c) remain stationary  
(d) rotate about an axis parallel to the wire.
31. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its flight if the air resistance is not ignored?



32. Radioactive nuclei that are injected into a patient collect at certain sites within its body, undergoing radioactive decay and emitting electromagnetic radiation. These radiations can then be recorded by a detector. This procedure provides an important diagnostic tool called  
(a) gamma camera (b) CAT scan  
(c) radiotracer technique  
(d) gamma ray spectroscopy.

33. In a material medium, when a positron meets an electron both the particles annihilate leading to the emission of two gamma ray photons. This process forms the basis of an important diagnostic procedure called

- (a) MRI (b) PET  
(c) CAT (d) SPECT.

34. An astronaut is looking down on earth's surface from a space shuttle at an altitude of 400 km. Assuming that the astronaut's pupil diameter is

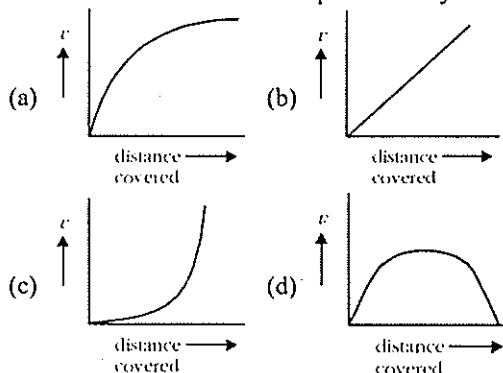
5 mm and the wavelength of visible light is 500 nm, the astronaut will be able to resolve linear objects of the size about

- (a) 0.5 m (b) 5 m  
(c) 50 m (d) 500 m.

35. An earthquake generates both transverse ( $S$ ) and longitudinal ( $P$ ) sound waves in the earth. The speed of  $S$  waves is about 4.5 km/s and that of  $P$  waves is about 8.0 km/s. A seismograph records  $P$  and  $S$  waves from an earthquake. The first  $P$  wave arrives 4.0 min before the first  $S$  wave. The epicentre of the earthquake is located at a distance about

- (a) 25 km (b) 250 km  
(c) 2500 km (d) 5000 km.

36. A lead shot of 1 mm diameter falls through a long column of glycerine. The variation of its velocity  $v$  with distance covered is represented by



37. The maximum distance upto which TV transmission from a TV tower of height  $h$  can be received is proportional to

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

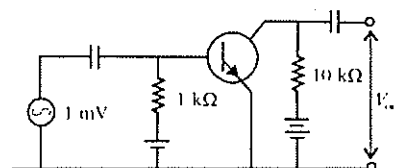
38. In short wave communication, waves of which of the following frequencies will be reflected back by the ionospheric layer having electron density  $10^{11}$  per  $m^3$ ?

- (a) 2 MHz (b) 10 MHz  
(c) 12 MHz (d) 18 MHz.

39. Using mass ( $M$ ), length ( $L$ ), time ( $T$ ) and current ( $A$ ) as fundamental quantities, the dimension of permeability is

- (a)  $M^{-1}LT^{-2}A$  (b)  $ML^2T^{-2}A^{-1}$   
(c)  $MLT^{-2}A^{-2}$  (d)  $MLT^{-1}A^{-1}$ .

40. In the following common emitter configuration an  $npn$  transistor with current gain  $\beta = 100$  is used. The output voltage of the amplifier will be



- (a) 10 mV (b) 0.1 V  
(c) 1.0 V (d) 10 V.

**Directions for questions 41 - 60 :** In the following questions a statement of assertion (A) is followed by a statement of reason (R). Of these statements, mark the correct answer:

- (a) if both assertion and reason are true and the reason is the correct explanation of the assertion  
(b) if both assertion and reason are true and the reason is not the correct explanation of the assertion  
(c) if assertion is true but reason is false  
(d) if both assertion and reason are false statements.

41. **Assertion :** Temperatures near the sea coast are moderate.

**Reason :** Water has a high thermal conductivity.

42. **Assertion :** The earth is slowing down and as a result the moon is coming nearer to it.

**Reason :** The angular momentum of the earth moon system is not conserved.

43. **Assertion :** A tube light emits white light.

**Reason :** Emission of light in a tube takes place at a very high temperature.

44. **Assertion :** Radioactive nuclei emit  $\beta^-$  particles.

**Reason :** Electrons exist inside the nucleus.

45. **Assertion :** The resistivity of a semiconductor increases with temperature.

**Reason :** The atoms of a semiconductor vibrate with larger amplitude at higher temperatures thereby increasing its resistivity.

46. **Assertion :** The Coulomb force is dominating force in the universe.

**Reason :** The Coulomb force is weaker than the gravitational force.

47. **Assertion :** The length of the day is slowly increasing.

*Reason* : The dominant effect causing a slowdown in the rotation of the earth is the gravitational pull of other planets in the solar system.

48. *Assertion* : Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

*Reason* : According to classical physics all moving electrons radiate.

49. *Assertion* : The possibility of an electric bulb fusing is higher at the time of switching on and off.

*Reason* : Inductive effects produce a surge at the time of switch-off and switch-on.

50. *Assertion* : The stars twinkle while the planets do not.

*Reason* : The stars are much bigger in size than the planets.

51. *Assertion* : A beam of charged particles is employed in the treatment of cancer.

*Reason* : Charged particles on passing through a material medium lose their energy by causing ionization of the atoms along their path.

52. *Assertion* : When a beetle moves along the sand within a few tens of centimeters of a sand scorpion, the scorpion immediately turns towards the beetle and dashes towards it.

*Reason* : When a beetle disturbs the sand, it sends pulses along the sand's surface. One set of pulses is longitudinal while the other set is transverse.

53. *Assertion* : When a bottle of cold carbonated drink is opened, a slight fog forms around the opening.

*Reason* : Adiabatic expansion of the gas causes lowering of temperature and condensation of water vapours.

54. *Assertion* : The size of a hydrogen balloon increases as it rises in air.

*Reason* : The material of the balloon can be easily stretched.

55. *Assertion* : Owls can move freely during night.  
*Reason* : They have large number of rods on their retina.

56. *Assertion* : It is hotter over the top of a fire than at the same distance on the sides.

*Reason* : Air surrounding the fire conducts more heat upwards.

57. *Assertion* : The amplitude of an oscillating pendulum decreases gradually with time.

*Reason* : The frequency of the pendulum decreases with time.

58. *Assertion* : Microwave communication is preferred over optical communication.

*Reason* : Microwaves provide large number of channels and bandwidth compared to optical signals.

59. *Assertion* : Neutrons penetrate matter more readily as compared to protons.

*Reason* : Neutrons are slightly more massive than protons.

60. *Assertion* : In high latitudes one sees colourful curtains of light hanging down from high altitudes.

*Reason* : The high energy charged particles from the sun are deflected to polar regions by the magnetic field of the earth.

## CHEMISTRY

61. The paramagnetic species is

(a)  $\text{KO}_2$  (b)  $\text{SiO}_2$   
(c)  $\text{TiO}_2$  (d)  $\text{BaO}_2$

62. The reagent commonly used to determine hardness of water titrimetrically is

(a) oxalic acid  
(b) disodium salt of EDTA  
(c) sodium citrate (d) sodium thiosulphate.

63. The true statement for the acids of phosphorus,  $\text{H}_3\text{PO}_2$ ,  $\text{H}_3\text{PO}_3$  and  $\text{H}_3\text{PO}_4$  is

(a) the order of their acidity is  $\text{H}_3\text{PO}_4 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_2$   
(b) all of them are reducing in nature  
(c) all of them are tribasic acids  
(d) the geometry of phosphorus is tetrahedral in all the three.

64. The ion which is not tetrahedral in shape is

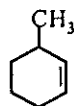
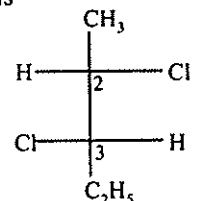
(a)  $\text{BF}_4^-$  (b)  $\text{NH}_4^+$   
(c)  $\text{Cu}(\text{NH}_3)_4^{2+}$  (d)  $\text{NiCl}_4^{2-}$

65. The complex used as an anti-cancer agent is

(a)  $\text{mer-}[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  (b)  $\text{cis-}[\text{PtCl}_2(\text{NH}_3)_2]$   
(c)  $\text{cis-K}_2[\text{PtCl}_2\text{Br}_2]$  (d)  $\text{Na}_2[\text{CoCl}_4]$

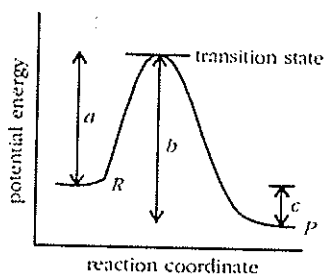
66. The colourless species is

(a)  $\text{VCl}_3$  (b)  $\text{VO}_2\text{SO}_4$

- (c)  $\text{Na}_3\text{VO}_4$   
(d)  $[\text{V}(\text{H}_2\text{O})_6] \text{SO}_4 \cdot \text{H}_2\text{O}$ .
67.  $\text{MnO}_4^{2-}$  (1 mole) in neutral aqueous medium is disproportionated to  
(a)  $\frac{2}{3}$  mole of  $\text{MnO}_4^-$  and  $\frac{1}{3}$  mole of  $\text{MnO}_2$   
(b)  $\frac{1}{3}$  mole of  $\text{MnO}_4^-$  and  $\frac{2}{3}$  mole of  $\text{MnO}_2$   
(c)  $\frac{1}{3}$  mole of  $\text{Mn}_2\text{O}_7$  and  $\frac{1}{3}$  mole of  $\text{MnO}_2$   
(d)  $\frac{2}{3}$  mole of  $\text{Mn}_2\text{O}_7$  and  $\frac{1}{3}$  mole of  $\text{MnO}_2$ .
68. Lanthanide for which +II and +III oxidation states are common is  
(a) La (b) Nd  
(c) Ce (d) Eu.
69. The mixture of concentrated HCl and  $\text{HNO}_3$  made in 3 : 1 ratio contains  
(a)  $\text{ClO}_2$  (b) NOCl  
(c)  $\text{NCl}_3$  (d)  $\text{N}_2\text{O}_4$ .
70. On dissolving moderate amount of sodium metal in liquid  $\text{NH}_3$  at low temperature, which one of the following does not occur?  
(a) blue coloured solution is obtained  
(b)  $\text{Na}^+$  ions are formed in the solution  
(c) liquid  $\text{NH}_3$  becomes good conductor of electricity  
(d) liquid ammonia remains diamagnetic.
71. The ligand called  $\pi$  acid is  
(a) CO (b)  $\text{NH}_3$   
(c)  $\text{C}_2\text{O}_4^{2-}$  (d) ethylene diamine.
72. The compound used for gravimetric estimation of copper(II) is  
(a)  $\text{Cu}_2(\text{SCN})_2$  (b)  $\text{Cu}_2\text{O}$   
(c)  $\text{Cu}_2\text{I}_2$  (d)  $\text{Cu}_2\text{CO}_3$ .
73. In the extraction of copper from sulphide ore the metal is formed by reduction of  $\text{Cu}_2\text{O}$  with  
(a) FeS (b) CO  
(c)  $\text{Cu}_2\text{S}$  (d)  $\text{SO}_2$ .
74. Among the following the strongest acid is  
(a)  $\text{CH}_3\text{COOH}$  (b)  $\text{C}_6\text{H}_5\text{COOH}$   
(c)  $m\text{-CH}_3\text{OC}_6\text{H}_4\text{COOH}$   
(d)  $p\text{-CH}_3\text{OC}_6\text{H}_4\text{COOH}$ .
75. Among the following the weakest base is  
(a)  $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$  (b)  $\text{C}_6\text{H}_5\text{CH}_2\text{NHCH}_3$   
(c)  $\text{O}_2\text{NCH}_2\text{NH}_2$  (d)  $\text{CH}_3\text{NHCHO}$ .
76. IUPAC name of  is  
(a) 3-methyl cyclohexene  
(b) 1-methyl cyclohex-2-ene  
(c) 6-methyl cyclohexene  
(d) 1-methyl cyclohex-5-ene.
77. Intermolecular hydrogen bonding is strongest in  
(a) methylamine (b) phenol  
(c) formaldehyde (d) methanol.
78. The *ortho/para* directing group among the following is  
(a)  $\text{COOH}$  (b) CN  
(c)  $\text{COCH}_3$  (d)  $\text{NHCOCH}_3$ .
79. The treatment of benzene with isobutene in the presence of sulphuric acid gives  
(a) *iso*-butyl benzene (b) *tert*-butyl benzene  
(c) *n*-butyl benzene (d) no reaction.
80. The most reactive nucleophile among the following is  
(a)  $\text{CH}_3\text{O}^-$  (b)  $\text{C}_6\text{H}_5\text{O}^-$   
(c)  $(\text{CH}_3)_2\text{CHO}^-$  (d)  $(\text{CH}_3)_3\text{CO}^-$ .
81. The absolute configuration of the following compound is  
  
(a) 2 S, 3 R (b) 2 S, 3 S  
(c) 2 R, 3 S (d) 2 R, 3 R.
82. Subunits present in haemoglobin are  
(a) 2 (b) 3  
(c) 4 (d) 5.
83. At higher temperature, iodoform reaction is given by  
(a)  $\text{CH}_3\text{CO}_2\text{CH}_3$  (b)  $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$   
(c)  $\text{C}_6\text{H}_5\text{CO}_2\text{CH}_3$  (d)  $\text{CH}_3\text{CO}_2\text{C}_6\text{H}_5$ .
84. Among the following, the achiral amino acid is  
(a) 2-ethylalanine (b) 2-methylglycine  
(c) 2-hydroxymethyl serine  
(d) tryptophan.

85. Nitrobenzene gives N-phenylhydroxylamine by  
 (a) Sn/HCl (b) H<sub>2</sub>/Pd-C  
 (c) Zn/NaOH (d) Zn/NH<sub>4</sub>Cl.
86. Propan-1-ol can be prepared from propene by  
 (a) H<sub>2</sub>O/H<sub>2</sub>SO<sub>4</sub>  
 (b) Hg(OAc)<sub>2</sub>/H<sub>2</sub>O followed by NaBH<sub>4</sub>  
 (c) B<sub>2</sub>H<sub>6</sub> followed by H<sub>2</sub>O<sub>2</sub>  
 (d) CH<sub>3</sub>CO<sub>2</sub>H/H<sub>2</sub>SO<sub>4</sub>.
87. Which of the following are arranged in the decreasing order of dipole moment?  
 (a) CH<sub>3</sub>Cl, CH<sub>3</sub>Br, CH<sub>3</sub>F  
 (b) CH<sub>3</sub>Cl, CH<sub>3</sub>F, CH<sub>3</sub>Br  
 (c) CH<sub>3</sub>Br, CH<sub>3</sub>Cl, CH<sub>3</sub>F  
 (d) CH<sub>3</sub>Br, CH<sub>3</sub>F, CH<sub>3</sub>Cl.
88. What is the co-ordination number of sodium in Na<sub>2</sub>O?  
 (a) 6 (b) 4  
 (c) 8 (d) 2.
89. Which of the following compounds possesses the C – H bond with the lowest bond dissociation energy?  
 (a) toluene (b) benzene  
 (c) n-pentane  
 (d) 2,2-dimethylpropane.
90. One gram sample of NH<sub>4</sub>NO<sub>3</sub> is decomposed in a bomb calorimeter. The temperature of the calorimeter increases by 6.12 K. The heat capacity of the system is 1.23 kJ/g/deg. What is the molar heat of decomposition for NH<sub>4</sub>NO<sub>3</sub>?  
 (a) – 7.53 kJ/mol (b) – 398.1 kJ/mol  
 (c) – 16.1 kJ/mol (d) – 602 kJ/mol.
91. Which one of the statements given below concerning properties of solutions, describes a colligative effect?  
 (a) Boiling point of pure water decreases by the addition of ethanol.  
 (b) Vapour pressure of pure water decreases by the addition of nitric acid.  
 (c) Vapour pressure of pure benzene decreases by the addition of naphthalene.  
 (d) Boiling point of pure benzene increases by the addition of toluene.
92. Which of the following reactions is used to make a fuel cell?  
 (a)  $\text{Cd}_{(s)} + 2\text{Ni}(\text{OH})_3_{(s)} \rightarrow \text{CdO}_{(s)} + 2\text{Ni}(\text{OH})_2_{(s)} + \text{H}_2\text{O}_{(l)}$   
 (b)  $\text{Pb}_{(s)} + \text{PbO}_{2(s)} + 2\text{H}_2\text{SO}_{4(aq)} \rightarrow 2\text{PbSO}_{4(s)} + 2\text{H}_2\text{O}_{(l)}$   
 (c)  $2\text{H}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{H}_2\text{O}_{(l)}$   
 (d)  $2\text{Fe}_{(s)} + \text{O}_{2(g)} + 4\text{H}^+_{(aq)} \rightarrow 2\text{Fe}^{2+}_{(aq)} + 2\text{H}_2\text{O}_{(l)}$
93. Which one of the following is not a buffer solution?  
 (a) 0.8M H<sub>2</sub>S + 0.8M KHS  
 (b) 2M C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub> + 2M C<sub>6</sub>H<sub>5</sub>NH<sub>3</sub><sup>+</sup>Br<sup>–</sup>  
 (c) 3M H<sub>2</sub>CO<sub>3</sub> + 3M KHCO<sub>3</sub>  
 (d) 0.05M KClO<sub>4</sub> + 0.05M HClO<sub>4</sub>.
94. Which one of the following has ΔS° greater than zero?  
 (a)  $\text{CaO}_{(s)} + \text{CO}_{2(g)} \rightleftharpoons \text{CaCO}_{3(s)}$   
 (b)  $\text{NaCl}_{(aq)} \rightleftharpoons \text{NaCl}_{(s)}$   
 (c)  $\text{NaNO}_{3(s)} \rightleftharpoons \text{Na}^+_{(aq)} + \text{NO}_3^-_{(aq)}$   
 (d)  $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$
95. The quantum number *m* of a free gaseous atom is associated with  
 (a) the effective volume of the orbital  
 (b) the shape of the orbital  
 (c) the spatial orientation of the orbital  
 (d) the energy of the orbital in the absence of a magnetic field.
96. Which one of the following is not a surfactant?  
 (a)  $\text{CH}_3 - (\text{CH}_2)_{15} - \overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{N}^+}} - \text{CH}_3\text{Br}^-$   
 (b)  $\text{CH}_3 - (\text{CH}_2)_{14} - \text{CH}_2 - \text{NH}_2$   
 (c)  $\text{CH}_3 - (\text{CH}_2)_{16} - \text{CH}_2\text{OSO}_2^- \text{Na}^+$   
 (d)  $\text{OHC} - (\text{CH}_2)_{14} - \text{CH}_2 - \text{COO}^- \text{Na}^+$
97. Time required to deposit one millimole of aluminium metal by the passage of 9.65 amperes through aqueous solution of aluminium ion is  
 (a) 30 s (b) 10 s  
 (c) 30,000 s (d) 10,000 s.
98. In which of the following acid-base titration, pH is greater than 8 at equivalence point?  
 (a) acetic acid versus ammonia  
 (b) acetic acid versus sodium hydroxide  
 (c) hydrochloric acid versus ammonia  
 (d) hydrochloric acid versus sodium hydroxide.
99. Which of the following is not a green house gas?  
 (a) carbon dioxide (b) water vapour  
 (c) methane (d) oxygen.

100. The potential energy diagram for a reaction  $R \rightarrow P$  is given in the figure.  $\Delta H^\circ$  of the reaction corresponds to the energy



- (a)  $a$   
 (b)  $b$   
 (c)  $c$   
 (d)  $a + b$ .

**Directions for questions 101 - 120 :** In the following questions a statement of assertion (A) is followed by a statement of reason (R). Of these statements, mark the correct choice:

- (a) if both assertion and reason are true and the reason is the correct explanation of the assertion  
 (b) if both assertion and reason are true and the reason is not the correct explanation of the assertion  
 (c) if assertion is true but reason is false  
 (d) if both assertion and reason are false.
101. **Assertion :** Solution of  $\text{Na}_2\text{CrO}_4$  in water is intensely coloured.  
**Reason :** Oxidation state of Cr in  $\text{Na}_2\text{CrO}_4$  is +VI.
102. **Assertion :**  $\text{NF}_3$  is a weaker ligand than  $\text{N}(\text{CH}_3)_3$ .  
**Reason :**  $\text{NF}_3$  ionizes to give  $\text{F}^-$  ions in aqueous solution.
103. **Assertion :**  $\text{PbI}_4$  is a stable compound.  
**Reason :** Iodide stabilizes higher oxidation state.
104. **Assertion :**  ${}^{22}_{11}\text{Na}$  emits a positron giving  ${}^{22}_{12}\text{Mg}$ .  
**Reason :** In  $\beta^+$  emission neutron is transformed into proton.
105. **Assertion :** Barium is not required for normal biological function in human.  
**Reason :** Barium does not show variable oxidation state.
106. **Assertion :** Haemoglobin is an oxygen carrier.  
**Reason :** Oxygen binds as  $\text{O}_2^-$  to Fe of haemoglobin.
107. **Assertion :** Glycosides are hydrolysed in acidic conditions.  
**Reason :** Glycosides are acetals.
108. **Assertion :** Benzyl bromide when kept in acetone water it produces benzyl alcohol.  
**Reason :** The reaction follows  $\text{S}_{\text{N}}2$  mechanism.
109. **Assertion :** Activity of an enzyme is pH dependent.  
**Reason :** Change in pH affects the solubility of the enzyme in water.
110. **Assertion :** Alkyl benzene is not prepared by Friedel-Crafts alkylation of benzene.  
**Reason :** Alkyl halides are less reactive than acyl halides.
111. **Assertion :** Hydroxyketones are not directly used in Grignard reaction.  
**Reason :** Grignard reagents react with hydroxyl group.
112. **Assertion :** *Trans*-2-butene on reaction with  $\text{Br}_2$  gives *meso*-2,3-dibromobutane.  
**Reason :** The reaction involves *syn*-addition of bromine.
113. **Assertion :** *Cis*-1,3-dihydroxycyclohexane exists in boat conformation.  
**Reason :** In the chair form, there will not be hydrogen bonding between the two hydroxyl groups.
114. **Assertion :** The increase in internal energy ( $\Delta E$ ) for the vapourization of one mole of water at 1 atm and 373 K is zero.  
**Reason :** For all isothermal processes,  $\Delta E = 0$ .
115. **Assertion :**  $\text{BaCO}_3$  is more soluble in  $\text{HNO}_3$  than in plain water.  
**Reason :** Carbonate is a weak base and reacts with the  $\text{H}^+$  from the strong acid, causing the barium salt to dissociate.
116. **Assertion :**  $\Delta H$  and  $\Delta E$  are almost the same for the reaction,  $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$ .  
**Reason :** All reactants and products are gases.
117. **Assertion :** Photochemical smog is produced by nitrogen oxides.  
**Reason :** Vehicular pollution is a major source of nitrogen oxides.
118. **Assertion :** Increasing pressure on pure water decreases its freezing point.  
**Reason :** Density of water is minimum at 273 K.
119. **Assertion :** The micelle formed by sodium stearate in water has  $-\text{COO}^-$  groups at the surface.




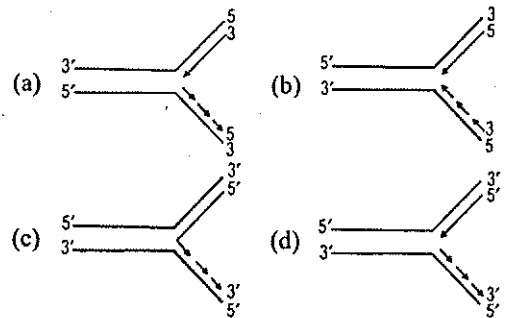
*Reason* : Surface tension of water is reduced by the addition of stearate.

120. *Assertion* : The O – O bond length in  $\text{H}_2\text{O}_2$  is shorter than that of  $\text{O}_2\text{F}_2$ .

*Reason* :  $\text{H}_2\text{O}_2$  is an ionic compound.

### BIOLOGY

121. The crystal of lead zirconate is a key component of :  
 (a) electroencephalography  
 (b) electrocardiography  
 (c) magnetoencephalography  
 (d) sonography.
122. Which one of the following is a matching pair of a certain body feature and its value/count in a normal human adult?  
 (a) urea - 5-10 mg/100 ml of blood  
 (b) blood sugar (fasting) - 80-100 mg/100 ml  
 (c) total blood volume - 3 - 4 litres  
 (d) ESR in Wintrobe method - 9-15 mm in males and 20-34 mm in females.
123. Which one of the following pairs of terms / names mean one and the same thing?  
 (a) gene pool - genome  
 (b) codon - gene (c) cistron - triplet  
 (d) DNA fingerprinting - DNA profiling.
124. Which one of the following is a matching pair?  
 (a) Lubb - sharp closure of AV valves at the beginning of ventricular systole  
 (b) Dup - sudden opening of semilunar valves at the beginning of ventricular diastole  
 (c) Pulsation of the radial artery - valves in the blood vessels  
 (d) Initiation of the heart beat - Purkinje fibres.
125. Mr. X is eating curd/yoghurt. For this food intake in a food chain he should be considered as occupying:  
 (a) first trophic level (b) second trophic level  
 (c) third trophic level (d) fourth trophic level.
126. July 11 is observed as:  
 (a) World population day  
 (b) No tobacco day  
 (c) World environment day  
 (d) World health day.
127. Biological Oxygen Demand (BOD) is a measure of:  
 (a) industrial wastes poured into water bodies  
 (b) extent to which water is polluted with organic compounds  
 (c) amount of carbon monoxide inseparably combined with haemoglobin  
 (d) amount of oxygen needed by green plants during night.
128. Which one of the following is a sesamoid bone?  
 (a) pelvis (b) patella  
 (c) pterygoid (d) pectoral girdle.
129. Both corpus luteum and macula lutea are:  
 (a) found in human ovaries  
 (b) a source of hormones  
 (c) characterized by a yellow colour  
 (d) contributory in maintaining pregnancy.
130. Photorespiration in  $\text{C}_3$  plants starts from:  
 (a) phosphoglycerate (b) phosphoglycolate  
 (c) glycerate (d) glycine.
131. Just as *Xenopsylla* is to *Yersenia pestis*, so is:  
 (a) *Glossina palpalis* to *Wuchereria bancrofti*  
 (b) *Culex* to *Plasmodium falciparum*  
 (c) *Homo sapiens* to *Taenia solium*  
 (d) *Phlebotomus* to *Leishmania donovani*.
132. Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to:  
 (a) vitamin toxicity (b) kidney stones  
 (c) hypercholesterolemia  
 (d) urine laden with ketone bodies.
133. Drinking of mineral water with very low level of pesticides (about 0.02 ppm) for long periods may:  
 (a) produce immunity against mosquito  
 (b) cause leukemia (blood cancer) in most people  
 (c) cause cancer of the intestine  
 (d) lead to accumulation of pesticide residues in body fat.
134. A person passes much urine and drinks much water but his blood glucose level is normal. This condition may be the result of :  
 (a) a reduction in insulin secretion from pancreas  
 (b) a reduction in vasopressin secretion from posterior pituitary  
 (c) a fall in the glucose concentration in urine  
 (d) an increase in secretion of glucagon.
135. What is true about tRNA?  
 (a) it binds with an amino acid at its 3' end

- (b) it has five double stranded regions  
 (c) it has a codon at one end which recognizes the anticodon on messenger RNA  
 (d) it looks like clover leaf in the three dimensional structure.
136. An example of competitive inhibition of an enzyme is the inhibition of:  
 (a) succinic dehydrogenase by malonic acid  
 (b) cytochrome oxidase by cyanide  
 (c) hexokinase by glucose-6-phosphate  
 (d) carbonic anhydrase by carbon dioxide.
137. Which one of the following is a matching pair of certain organism(s) and the kind of association?  
 (a) shark and sucker fish - commensalism  
 (b) algae and fungi in lichens - mutualism  
 (c) orchids growing on trees - parasitism  
 (d) cuscuta (dodder) growing in other flowering plants - epiphytism.
138. Photochemical smog formed in congested metropolitan cities mainly consists of:  
 (a) ozone, peroxyacetyl nitrate and  $\text{NO}_x$   
 (b) smoke, peroxyacetyl nitrate and  $\text{SO}_2$   
 (c) hydrocarbons,  $\text{SO}_2$  and  $\text{CO}_2$   
 (d) hydrocarbons, ozone and  $\text{SO}_x$ .
139. In almost all Indian metropolitan cities like Delhi, the major atmospheric pollutant(s) is/are:  
 (a) suspended particulate matter (SPM)  
 (b) oxides of sulphur  
 (c) carbon dioxide and carbon monoxide  
 (d) oxides of nitrogen.
140. Excessive stimulation of vagus nerve in humans may lead to:  
 (a) hoarse voice (b) peptic ulcers  
 (c) efficient digestion of proteins  
 (d) irregular contractions of diaphragm.
141. Restriction enzymes:  
 (a) are endonucleases which cleave DNA at specific sites  
 (b) make DNA complementary to an existing DNA or RNA  
 (c) cut or join DNA fragments  
 (d) are required in vectorless direct gene transfer.
142. The map given below indicates the former and the present distribution of an animal:  
 Which animal could it be:  
 (a) Wild ass  
 (b) Nilgai  
 (c) Black buck  
 (d) Lion.
- 
143. Which one of the following correctly represents the manner of replication of DNA?
- 
144. Which one of the following codons codes for the same information as UGC?  
 (a) UGU (b) UGA  
 (c) UAG (d) UGG.
145. A person is wearing spectacles with concave lenses for correcting vision. While not using the glasses, the image of a distant object in his case will be formed:  
 (a) on the blind spot (b) behind the retina  
 (c) in front of the retina (d) on the yellow spot.
146. The early stage human embryo distinctly possesses:  
 (a) gills (b) gill slits  
 (c) external ear (pinna) (d) eye brows.
147. The phase of menstrual cycle in humans that last for 7-8 days, is:  
 (a) follicular phase (b) ovulatory phase  
 (c) luteal phase (d) menstruation.
148. The source of somatostatin is same as that of:  
 (a) thyroxine and calcitonin  
 (b) insulin and glucagon  
 (c) somatotropin and prolactin  
 (d) vasopresin and oxytocin.
149. People recovering from long illness are often advised to include the alga *Spirulina* in their diet because it:  
 (a) makes the food easy to digest

- (b) is rich in proteins  
(c) has antibiotic properties  
(d) restores the intestinal microflora.
150. Viroids have:  
(a) single stranded RNA not enclosed by protein coat  
(b) single stranded DNA not enclosed by protein coat  
(c) double stranded DNA enclosed by protein coat  
(d) double stranded RNA enclosed by protein coat.
151. In a dicotyledonous stem, the sequence of tissues from the outside to the inside is:  
(a) phellem - pericycle - endodermis - phloem  
(b) phellem - phloem - endodermis - pericycle  
(c) phellem - endodermis - pericycle - phloem  
(d) pericycle - phellem - endodermis - phloem.
152. Hill reaction occurs in:  
(a) high altitude plants (b) total darkness  
(c) absence of water  
(d) presence of ferricyanide.
153. Which one of the following pairs is correctly matched:  
(a) *Rhizobium* - Parasite in the roots of leguminous plants  
(b) Mycorrhizae - Mineral uptake from soil  
(c) Yeast - Production of biogas  
(d) Myxomycetes - The disease ring worm.
154. Pollen grains are able to withstand extremes of temperature and dessication because their exine is composed of:  
(a) cutin (b) suberin  
(c) sporopollenin (d) callose.
155. One of the genes present exclusively on the X-chromosome in humans is concerned with  
(a) baldness  
(b) red-green colour blindness  
(c) facial hair/moustaches in males  
(d) night blindness.
156. Which one of the following statements with regard to embryonic development in humans is correct?  
(a) cleavage divisions bring about considerable increase in the mass of protoplasm  
(b) in the second cleavage division, one of the two blastomeres usually divides a little sooner than the second  
(c) with more cleavage divisions, the resultant blastomeres become larger and larger  
(d) cleavage division results in a hollow ball of cells called morula.
157. Plasmodesmata connections help in:  
(a) cytoplasmic streaming  
(b) synchronous mitotic divisions  
(c) locomotion of unicellular organism  
(d) movement of substances between cells.
158. The quiescent centre in root meristem serves as a  
(a) site for storage of food which is utilized during maturation  
(b) reservoir of growth hormones  
(c) reserve for replenishment of damaged cells of the meristem  
(d) region for absorption of water.
159. *Azolla* is used as a biofertilizer because it  
(a) multiplies very fast to produce massive biomass  
(b) has association of nitrogen - fixing *Rhizobium*  
(c) has association of nitrogen - fixing cyanobacteria  
(d) has association of mycorrhiza.
160. The plant part which consists of two generations, one within the other, is:  
(a) germinated pollen grain (b) embryo  
(c) unfertilized ovule (d) seed.
- Directions for questions 161 - 180 :** In the following questions, a statement of assertion (A) is followed by a statement of reason (R).
- (a) If both Assertion and Reason are true and the reason is the correct explanation of the assertion, then mark (a)  
(b) If both Assertion and 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 :** Mast cells in the human body release excessive amounts of inflammatory chemicals which cause allergic reactions.  
**Reason :** Allergens in the environment on reaching human body stimulate mast cells in certain individuals.
162. **Assertion :** Use of fertilizers greatly enhances crop productivity.  
**Reason :** Irrigation is very important in increasing crop productivity.
163. **Assertion :** Smaller the organism higher is the rate

of metabolism per gram weight.

*Reason* : The heart rate of a six month old baby is much higher than that of an old person.

164. *Assertion* : Bats and whales are classified as mammals.

*Reason* : Bats and whales have four-chambered heart.

165. *Assertion* : Severe Acute Respiratory Syndrome (SARS) originated in China.

*Reason* : China is the most populated country of the world.

166. *Assertion* : Organochlorine pesticides are organic compounds that have been chlorinated.

*Reason* : Fenitrothion is one of the organochlorine pesticides.

167. *Assertion* : Holoblastic cleavage with almost equal-sized blastomeres is a characteristic of placental animals.

*Reason* : Eggs of most mammals, including humans, are of centrolecithal type.

168. *Assertion* : Inhabitants close to very busy airports are likely to experience health hazards.

*Reason* : Sound level of jet aeroplanes usually exceeds 160 dB.

169. *Assertion* : All birds, except the ones like koel (cuckoo) build nests for retiring and taking rest during night time (day time for nocturnal)

*Reason* : Koel lays its eggs in the nests of tailor bird.

170. *Assertion* : Old age is not an illness. It is a continuation of life with decreasing capacity for adaptation.

*Reason* : Cessation of mitosis is a normal genetically programmed event.

171. *Assertion* : A cell membrane shows fluid behaviour.

*Reason* : A membrane is a mosaic or composite of diverse lipids and proteins.

172. *Assertion* : In plant tissue culture, somatic embryos can be induced from any plant cell.

*Reason* : Any viable plant cell can differentiate into somatic embryos.

173. *Assertion* : *Rhoeo* leaves contain anthocyanin pigments in epidermal cells.

*Reason* : Anthocyanins are accessory photosynthetic pigments.

174. *Assertion* : Water and mineral uptake by root hairs

from the soil occurs through apoplast until it reaches endodermis.

*Reason* : Casparian strips in endodermis are suberized.

175. *Assertion* : Long distance flow of photoassimilates in plants occurs through sieve tubes.

*Reason* : Mature sieve tubes have parietal cytoplasm and perforated sieve plates.

176. *Assertion* : Many visitors to the hills suffer from skin and respiratory allergy problem.

*Reason* : Conifer trees produce a large quantity of wind-borne pollen grains.

177. *Assertion* : Yeasts such as *Saccharomyces cerevisiae* are used in baking industry.

*Reason* : Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion.

178. *Assertion* : In a food chain members of successive higher levels are fewer in number.

*Reason* : Number of organisms at any trophic level depends upon the availability of organisms which serve as food at the lower level.

179. *Assertion* : Tropical rain forests are disappearing fastly from developing countries such as India.

*Reason* : No value is attached to these forests because these are poor in biodiversity.

180. *Assertion* : Leaf butterfly and stick insect show mimicry to dodge their enemies.

*Reason* : Mimicry is a method to acquire body colour blending with the surroundings.

### GENERAL KNOWLEDGE

181. Euthanasia (mercy killing) was first legalized in :

(a) Switzerland  
(b) Netherland (Holland)  
(c) France (d) Italy.

182. Positron emission tomography (PET) is one of the best methods for functional imaging because :

(a) isotopes of basic body elements are used for imaging  
(b) isotopes with long half-lives are used  
(c) isotopes with short half-lives are used  
(d) positrons are directly involved used in imaging.

183. Magnetic resonance (MR) images are derived from the proton-bearing species present principally from water and :

- (a) long alkane chain protons of the fatty acid moieties  
 (b) short alkane chain protons of the fatty acid moieties  
 (c) long alkene chain protons of the fatty acid moieties  
 (d) short alkene chain protons of the fatty acid moieties.
184. The following separation technique depends on the molecular size of the protein:  
 (a) chromatography on a carboxymethyl (CM) cellulose column  
 (b) iso-electric focusing  
 (c) gel filtration chromatography  
 (d) chromatography on a diethylaminoethyl (DEAE) cellulose column.
185. The approximate number of genes contained in the genome of Kalpana Chawla was:  
 (a) 40,000 (b) 30,000  
 (c) 80,000 (d) 1,00,000.
186. In internet what does 'http' mean?  
 (a) High Transfer Text Protocol  
 (b) Highest Transfer Text Protocol  
 (c) Hyper Text Transfer Protocol  
 (d) Hyper Transfer Text Protocol.
187. The Indian-born US physicist who was awarded the Nobel Prize in Physics for his work on astrophysics is:  
 (a) H.G. Khorana  
 (b) Subramanyam Chandrasekhar  
 (c) Sivaramakrishna Chandrasekhar  
 (d) C.V. Raman.
188. Which German physicist invented the electron microscope which won him the 1986 Nobel Prize in Physics?  
 (a) Ernst Ruska (b) Van't Hoff  
 (c) J.H.D. Jensen (d) Eugene P. Wigner.
189. Who was the first Indian to be awarded the World Food Prize in 1987?  
 (a) M.S. Swaminathan (b) Sunderlal Bahuguna  
 (c) Anna Hazare (d) B.R. Barwale.
190. Thanatology is the science that deals with:  
 (a) death in all its aspects  
 (b) solving paternity of child  
 (c) identification of living  
 (d) detection of lie.
191. What is the disease, Tetanus also known as?  
 (a) Gangrene (b) Shingles  
 (c) Lockjaw (d) Whooping cough.
192. When seen from earth, which of the following planet eclipsed (crossed a cross) of the sun on May 7, 2003?  
 (a) Mercury (b) Uranus  
 (c) Saturn (d) Jupiter.
193. Israel's Prime Minister Yitshak Rabin won the Nobel Prize for:  
 (a) peace (b) literature  
 (c) chemistry (d) economics.
194. Who was the world's first space tourist?  
 (a) Desmond Rickett (b) Dennis Tito  
 (c) Igor Kajelinkov (d) Li Wang.
195. Which city was gifted to Charles II by the Portuguese when he married the sister of the King of Portugal in 1662?  
 (a) Mumbai (b) Paris  
 (c) Lisbon (d) Castille.
196. How many "World Cultural Heritage Sites" are there in India?  
 (a) 10 (b) 17  
 (c) 14 (d) 15.
197. Who is the mother of Bharat in the epic Ramayana?  
 (a) Kaushalya (b) Sumitra  
 (c) Urmila (d) Kaikayee.
198. Which is the 'Nawab of Bengal' is supposed to be responsible for 'Black Hole' of Calcutta (Kolkatta)?  
 (a) Mir Jafer (b) Sirajuddaula  
 (c) Alivardi Khan (d) Sarfaraj Khan.
199. In which country the 'Dogs' were once worshipped as 'Gods'?  
 (a) Egypt (b) Greece  
 (c) Italy (d) Mangolia.
200. From which of the following places the international dateline crosses:  
 (a) Atlantic ocean (b) Pacific ocean  
 (c) Greenwich (d) Cape of Good Hope.

