SOLVED PAPER
AIIMS - 2004

Time : 3½ Hours Max. Marks : 200

PHYSICS

1. The waves produced by a motorboat sailing in water are
   (a) transverse (b) longitudinal
   (c) longitudinal and transverse
   (d) stationary.

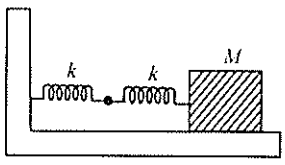
2. In an orbital motion, the angular momentum vector is
   (a) along the radius vector
   (b) parallel to the linear momentum
   (c) in the orbital plane
   (d) perpendicular to the orbital plane.

3. A nucleus of mass number A, originally at rest, emits an α-particle with speed v. The daughter nucleus recoils with a speed
   (a) $\frac{2v}{A+4}$ (b) $\frac{4v}{A+4}$
   (c) $\frac{4v}{A-4}$ (d) $\frac{2v}{A-4}$

4. When an electron-positron pair annihilates, the energy released is about
   (a) 0.8×10^{-13} J (b) 1.6×10^{-13} J
   (c) 3.2×10^{-13} J (d) 4.8×10^{-13} J.

5. A sphere of mass M and radius R is falling in a viscous fluid. The terminal velocity attained by the falling object will be proportional to
   (a) R^2 (b) R
   (c) $1/R$ (d) $1/R^2$.

6. Two springs are connected to a block of mass M placed on a frictionless surface as shown below. If both the springs have a spring constant k, the frequency of oscillation of the block is



   (a) $\frac{1}{2\pi}\sqrt{\frac{k}{M}}$ (b) $\frac{1}{2\pi}\sqrt{\frac{k}{2M}}$
   (c) $\frac{1}{2\pi}\sqrt{\frac{2k}{M}}$ (d) $\frac{1}{2\pi}\sqrt{\frac{M}{k}}$.

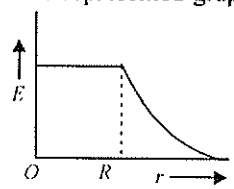
7. A photon of energy 4 eV is incident on a metal surface whose work function is 2 eV. The minimum reverse potential to be applied for stopping the emission of electrons is
   (a) 2 V (b) 4 V
   (c) 6 V (d) 8 V.

8. A proton and an α-particle, moving with the same velocity, enter into a uniform magnetic field, acting normal to the plane of their motion. The ratio of the radii of the circular paths described by the proton and α-particle is
   (a) 1 : 2 (b) 1 : 4
   (c) 1 : 16 (d) 4 : 1.

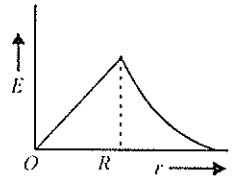
9. Two parallel beams of positrons moving in the same direction will
   (a) repel each other
   (b) will not interact with each other
   (c) attract each other
   (d) be deflected normal to the plane containing the two beams

10. The electric field due to a uniformly charged sphere of radius R as a function of the distance from its centre is represented graphically by

(a)



(b)



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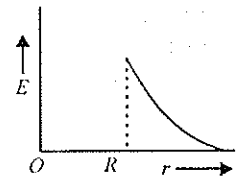

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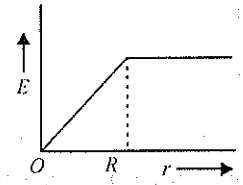
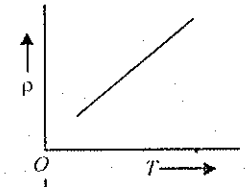
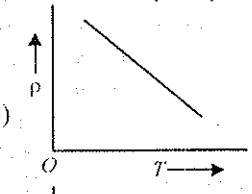


11. Equipotential surfaces associated with an electric field which is increasing in magnitude along the x-direction are
(a) planes parallel to yz-plane
(b) planes parallel to xy-plane
(c) planes parallel to xz-plane
(d) coaxial cylinders of increasing radii around the x-axis.

12. Suppose the sun expands so that its radius becomes 100 times its present radius and its surface temperature becomes half of its present value. The total energy emitted by it then will increase by a factor of
(a) 10^4 (b) 625
(c) 256 (d) 16.

13. The temperature (T) dependence of resistivity (ρ) of a semiconductor is represented by

(a)


(b)


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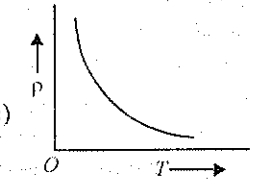

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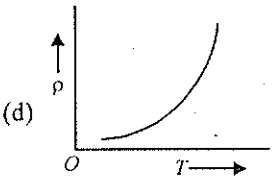


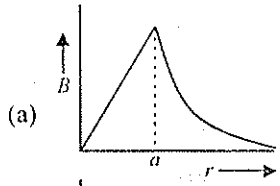
14. In old age arteries carrying blood in the human body become narrow resulting in an increase in the blood pressure. This follows from
(a) Pascal's law (b) Stoke's law
(c) Bernoulli's principle
(d) Archimedes principle.

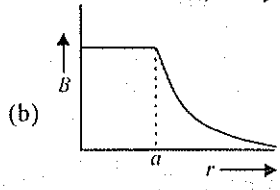
15. The direction of the angular velocity vector is along
(a) the tangent to the circular path
(b) the inward radius (c) the outward radius
(d) the axis of rotation.

16. A circular coil of radius R carries an electric current. The magnetic field due to the coil at a point on the axis of the coil located at a distance r from the center of the coil, such that $r >> R$, varies as
(a) $1/r$ (b) $1/r^{3/2}$
(c) $1/r^2$ (d) $1/r^3$.

17. Sodium lamps are used in foggy conditions because
(a) yellow light is scattered less by the fog particles
(b) yellow light is scattered more by the fog particles
(c) yellow light is unaffected during its passage through the fog
(d) wavelength of yellow light is the mean of the visible part of the spectrum.

18. The magnetic field due to a straight conductor of uniform cross-section of radius a and carrying a steady current is represented by

(a)


(b)


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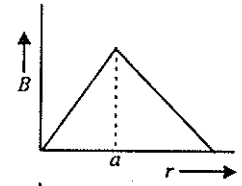

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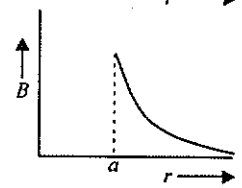
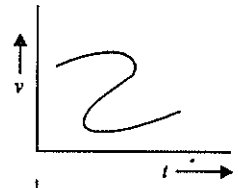
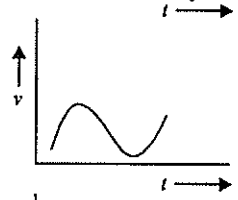
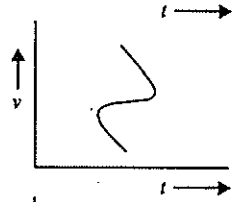
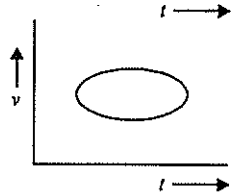


19. Which of the following velocity-time graphs shows a realistic situation for a body in motion?

(a)


(b)


(c)


(d)


20. A bomb of mass 3.0 kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at a speed of 80 m/s. The total energy imparted to the two fragments is
(a) 1.07 kJ (b) 2.14 kJ
(c) 2.4 kJ (d) 4.8 kJ.

21. A monochromatic beam of light is used for the formation of fringes on the screen by illuminating the two slits in the Young's double slit interference experiment. When a thin film of mica is interposed in the path of one of the interfering beams then
(a) the fringe width increases
(b) the fringe width decreases
(c) the fringe width remains the same but the pattern shifts
(d) the fringe pattern disappears.

22. An object is immersed in a fluid. In order that the object becomes invisible, it should
(a) behave as a perfect reflector
(b) absorb all light falling on it
(c) have refractive index one
(d) have refractive index exactly matching with that of the surrounding fluid.

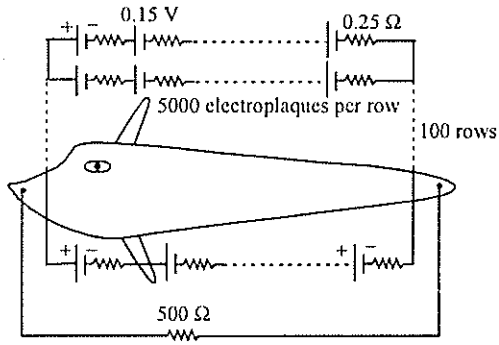
23. An organ pipe closed at one end has fundamental frequency of 1500 Hz. The maximum number of overtones generated by this pipe which a normal person can hear is
(a) 14 (b) 13
(c) 6 (d) 9.

24. The Magnetic Resonance Imaging (MRI) is based on the phenomenon of
(a) nuclear magnetic resonance
(b) electron spin resonance
(c) electron paramagnetic resonance
(d) diamagnetism of human tissues.

25. Carbon dating is best suited for determining the age of fossils if their age in years is of the order of
(a) 10^3 (b) 10^4
(c) 10^5 (d) 10^6.

26. A 40 μF capacitor in a defibrillator is charged to 3000 V. The energy stored in the capacitor is sent through the patient during a pulse of duration 2 ms. The power delivered to the patient is
(a) 45 kW (b) 90 kW
(c) 180 kW (d) 360 kW.

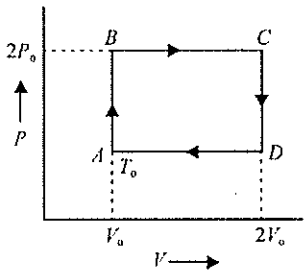
27. Eels are able to generate current with biological cells called electroplaques. The electroplaques in an eel are arranged in 100 rows, each row stretching horizontally along the body of the fish containing 5000 electroplaques. The arrangement is suggestively shown below. Each electroplaques has an emf of 0.15 V and internal resistance of 0.25 Ω.



The water surrounding the eel completes a circuit between the head and its tail. If the water surrounding it has a resistance of 500 Ω, the current an eel can produce in water is about

(a) 1.5 A (b) 3.0 A
(c) 15 A (d) 30 A.

28. N moles of a monoatomic gas is carried round the reversible rectangular cycle $ABCDA$ as shown in the diagram. The temperature at A is T_0. The thermodynamic efficiency of the cycle is



(a) 15% (b) 50%
(c) 20% (d) 25%.

29. Liquid oxygen remains suspended between two pole faces of a magnet because it is

(a) diamagnetic (b) paramagnetic
(c) ferromagnetic (d) antiferromagnetic.

30. An endoscope is employed by a physician to view the internal parts of a body organ. It is based on the principle of

(a) refraction
(b) reflection
(c) total internal reflection
(d) dispersion.

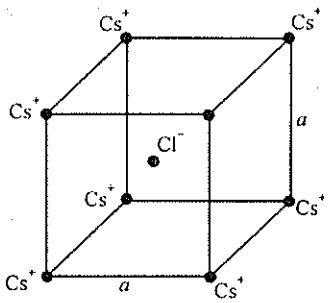
31. We wish to see inside an atom. Assuming the atom to have a diameter of 100 pm, this means that one must be able to resolve a width of say 10 pm. If an electron microscope is used, the minimum electron energy required is about

(a) 1.5 keV (b) 15 keV
(c) 150 keV (d) 1.5 MeV.

32. When a compact disc is illuminated by a source of white light, coloured lines are observed. This is due to

(a) dispersion (b) diffraction
(c) interference (d) refraction.

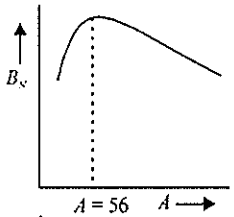
33. In the basic CsCl crystal structure, Cs^+ and Cl^- ions are arranged in a bcc configuration as shown in the figure. The net electrostatic force exerted by the eight Cs^+ ions on the Cl^- ions is

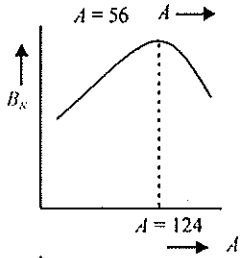


(a) $\frac{1}{4\pi\varepsilon_0}\frac{4e^2}{3a^2}$ (b) $\frac{1}{4\pi\varepsilon_0}\frac{16e^2}{3a^2}$

(c) $\frac{1}{4\pi\varepsilon_0}\frac{32e^2}{3a^2}$ (d) zero.

34. The dependence of binding energy per nucleon, B_N, on the mass number A, is represented by

(a)


(b)


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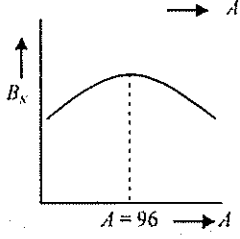
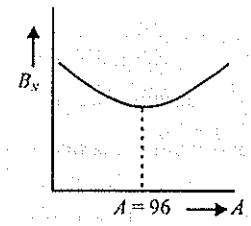
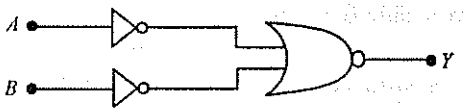


(d) 

35. The magnetic moment of a current (I) carrying circular coil of radius (r) and number of turns (n) varies as
(a) $1/r^2$ (b) $1/r$
(c) r (d) r^2.

36. The cyclotron frequency of an electron gyrating in a magnetic field of 1 T is approximately
(a) 28 MHz (b) 280 MHz
(c) 2.8 GHz (d) 28 GHz.

37. Which logic gate is represented by the following combination of logic gates?



(a) OR (b) NAND
(c) AND (d) NOR.

38. A Ge specimen is doped with Al. The concentration of acceptor atoms is ~ 10^{21} atoms/m^3. Given that the intrinsic concentration of electron-hole pairs is ~ 10^{19}/m^3, the concentration of electrons in the specimen is
(a) 10^{17}/m^3 (b) 10^{15}/m^3
(c) 10^4/m^3 (d) 10^2/m^3.

39. v_{rms}, v_{av} and v_{mp} are root mean square, average and most probable speeds of molecules of a gas obeying Maxwellian velocity distribution. Which of the following statements is correct?
(a) $v_{rms} < v_{av} < v_{mp}$ (b) $v_{rms} > v_{av} > v_{mp}$
(c) $v_{mp} < v_{rms} < v_{av}$ (d) $v_{mp} > v_{rms} > v_{av}$

40. Using mass (M), length (L), time (T) and current (A) as fundamental quantities, the dimension of permittivity is
(a) $ML^{-2}T^2A$ (b) $M^{-1}L^{-3}T^4A^2$
(c) $MLT^{-2}A$ (d) $ML^2T^{-1}A^2$.

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

41. *Assertion* : A larger dry cell has higher emf.
Reason : The emf of a dry cell is proportional to its size.

42. *Assertion* : A red object appears dark in the yellow light.
Reason : The red colour is scattered less.

43. *Assertion* : In a pressure cooker the water is brought to boil. The cooker is then removed from the stove. Now on removing the lid of the pressure cooker, the water starts boiling again.
Reason : The impurities in water bring down its boiling point.

44. *Assertion* : The true geographic north direction is found by using a compass needle.
Reason : The magnetic meridian of the earth is along the axis of rotation of the earth.

45. *Assertion* : There are very small sporadic changes in the period of rotation of the earth.
Reason : Shifting of large air masses in the earth's atmosphere produce a change in the moment of inertia of the earth causing its period of rotation to change.

46. *Assertion* : In a transistor the base is made thin.
Reason : A thin base makes the transistor stable.

47. *Assertion* : ^{90}Sr from the radioactive fall out from a nuclear bomb ends up in the bones of human beings through the milk consumed by them. It causes impairment of the production of red blood cells.
Reason : The energetics β-particles emitted in the decay of ^{90}Sr damage the bone marrow.

48. *Assertion* : At the first glance, the top surface of the Morpho butterfly's wing appears a beautiful blue-green. If the wing moves the colour changes.
Reason : Different pigments in the wing reflect light at different angles.

49. *Assertion* : A famous painting was painted by not using brush strokes in the usual manner, but rather a myriad of small colour dots. In this painting the colour you see at any given place on the painting changes as you move away.
Reason : The angular separation of adjacent dots changes with the distance from the painting.

50. *Assertion* : A disc-shaped magnet is leviated above a superconducting material that has been cooled by liquid nitrogen.
Reason : Superconductors repel a magnet.

51. *Assertion* : Energy is released in nuclear fission.
Reason : Total binding energy of the fission fragments is larger than the total binding energy of the parent nucleus.

52. *Assertion* : Smaller drops of liquid resist deforming forces better than the larger drops.
Reason : Excess pressure inside a drop is directly proportional to its surface area.

53. *Assertion* : The melting point of ice decreases with increase of pressure.
Reason : Ice contracts on melting.

54. *Assertion* : Heavy water preferred over ordinary water as a moderator in reactors.
Reason : Heavy water, used for slowing down the neutrons, has lesser absorption probability of neutrons than ordinary water.

55. *Assertion* : The driver in a vehicle moving with a constant speed on a straight road is in a non-inertial frame of reference.
Reason : A reference frame in which Newton's laws of motion are applicable is non-inertial.

56. *Assertion* : In He-Ne laser, population inversion takes place between energy levels of neon atoms.
Reason : Helium atoms have a meta-stable energy level.

57. *Assertion* : A transistor amplifier in common emitter configuration has a low input impedence.
Reason : The base to emitter region is forward biased.

58. *Assertion* : Thermodynamic process in nature are irreversible.
Reason : Dissipative effects cannot be eliminated.

59. *Assertion* : Crystalline solids can cause X-rays to diffract.
Reason : Interatomic distance in crystalline solids is of the order of 0.1 nm.

60. *Assertion* : Photoelectric effect demonstrates the wave nature of light.
Reason : The number of photoelectrons is proportional to the frequency of light.

CHEMISTRY

61. Which of the following is only acidic in nature?
(a) $Be(OH)_2$ (b) $Mg(OH)_2$
(c) $B(OH)_3$ (d) $Al(OH)_3$.

62. Which one of the following forms with an excess of CN^- (cyanide) a complex having coordination number two?
(a) Cu^+ (b) Ag^+
(c) Ni^{2+} (d) Fe^{2+}.

63. Which of the following is not considered as an organometallic compound?
(a) *cis*-platin (b) ferrocene
(c) Zeise's salt (d) Grignard reagent.

64. Dimethyl glyoxime gives a red precipitate with Ni^{2+}, which is used for its detection. To get this precipitate readily the best pH range is
(a) < 1 (b) 2 - 3
(c) 3 - 4 (d) 9 - 11.

65. The element which forms oxides in all oxidation states +I to +V is
(a) N (b) P
(c) As (d) Sb.

66. For decolourization of 1 mole of $KMnO_4$, the moles of H_2O_2 required is
(a) 1/2 (b) 3/2
(c) 5/2 (d) 7/2.

67. The statement true for N_3^- is
(a) it has a non-linear structure
(b) it is called pseudohalogen
(c) the formal oxidation state of nitrogen in this anion is –1
(d) it is isoelectronic with NO_2.

68. Which of the following does not have optical isomer?
(a) $[Co(NH_3)_3Cl_3]$ (b) $[Co(en)_3]Cl_3$
(c) $[Co(en)_2Cl_2]Cl$
(d) $[Co(en)(NH_3)_2Cl_2]Cl$.

69. For electron affinity of halogens which of the following is correct?
(a) Br > F (b) F > Cl
(c) Br > Cl (d) F > I.

70. Shape of O_2F_2 is similar to that of
(a) C_2F_2 (b) H_2O_2
(c) H_2F_2 (d) C_2H_2.

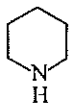
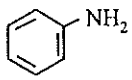
71. The liquefied metal expanding on solidification is
(a) Ga (b) Al
(c) Zn (d) Cu.

72. The compound insoluble in water is
(a) mercurous nitrate (b) mercuric nitrate
(c) mercurous chloride
(d) mercurous perchlorate.

73. Which of the following imparts green colour to the burner flame?
(a) $B(OMe)_3$ (b) Na(OMe)
(c) $Al(OPr)_3$ (d) $Sn(OH)_2$.

74. The ONO angle is maximum in
(a) NO_3^- (b) NO_2^-
(c) NO_2 (d) NO_2^+.

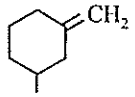
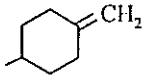
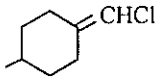
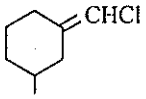
75. Among the following the dissociation constant is highest for
(a) C_6H_5OH (b) $C_6H_5CH_2OH$
(c) $CH_3C \equiv CH$ (d) $CH_3NH_3^+Cl^-$.

76. The strongest base among the following is
(a)  (b) 
(c)  (d) 

77. The compound having only primary hydrogen atoms is
(a) isobutene (b) 2,3-dimethylbutene
(c) cyclohexane (d) propyne.

78. Among the following the aromatic compound is
(a)  (b) 
(c)  (d) 

79. The dipole moment is the highest for
(a) *trans*-2-butene (b) 1,3-dimethylbenzene
(c) acetophenone (d) ethanol.

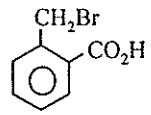
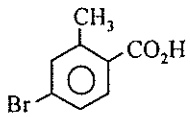
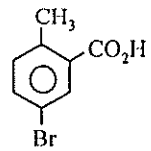
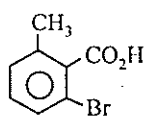
80. The geometrical isomerism is shown by
(a)  (b) 
(c)  (d) 

81. The reagent used for the separation of acetaldehyde from acetophenone is
(a) $NaHSO_3$ (b) $C_6H_5NHNH_2$
(c) NH_2OH (d) $NaOH - I_2$.

82. Among the following the most reactive towards alcoholic KOH is
(a) $CH_2 = CHBr$ (b) $CH_3COCH_2CH_2Br$
(c) CH_3CH_2Br (d) $CH_3CH_2CH_2Br$.

83. Among the following, the one which reacts most readily with ethanol is
(a) *p*-nitrobenzyl bromide
(b) *p*-chlorobenzyl bromide
(c) *p*-methoxybenzyl bromide
(d) *p*-methylbenzyl bromide.

84. The nucleic acid base having two possible binding sites is
(a) thymine (b) cytosine
(c) guanine (d) adenine.

85. *o*-Toluic acid on reaction with Br_2 + Fe gives
(a)  (b) 
(c)  (d) 

86. Aromatic nitriles (ArCN) are not prepared by reaction:
(a) Ar X + KCN (b) $ArN_2^+ + CuCN$
(c) $ArCONH_2 + P_2O_5$ (d) $ArCONH_2 + SOCl_2$.

87. Melting points are normally the highest for
(a) tertiary amides (b) secondary amides
(c) primary amides (d) amines.

88. The most suitable reagent for the conversion of $RCH_2OH \rightarrow RCHO$ is
(a) $KMnO_4$ (b) $K_2Cr_2O_7$
(c) CrO_3
(d) PCC (pyridine chloro chromate).

89. Which of the following is arranged in the increasing order of enthalpy of vaporization?
(a) NH_3, PH_3, AsH_3 (b) AsH_3, PH_3, NH_3
(c) NH_3, AsH_3, PH_3 (d) PH_3, AsH_3, NH_3.

90. For principle quantum number $n = 4$, the total number of orbitals having $l = 3$ is
(a) 3 (b) 7
(c) 5 (d) 9.

91. The average osmotic pressure of human blood is 7.8 bar at 37°C. What is the concentration of an aqueous NaCl solution that could be used in the blood stream?
(a) 0.16 mol/L (b) 0.32 mol/L
(c) 0.60 mol/L (d) 0.45 mol/L.

92. How much energy is released when 6 moles of octane is burnt in air? Given ΔH_f° for $CO_{2\,(g)}$, $H_2O_{(g)}$ and $C_8H_{18\,(l)}$ respectively are – 490, –240 and +160 kJ/mol.
(a) – 6.2 kJ (b) – 37.4 kJ
(c) – 35.5 kJ (d) – 20.0 kJ.

93. For the equilibrium $H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$ at 1 atm and 298 K,
(a) standard free energy change is equal to zero ($\Delta G^\circ = 0$)
(b) free energy change is less than zero ($\Delta G < 0$)
(c) standard free energy change is less than zero ($\Delta G^\circ < 0$)
(d) standard free energy change is greater than zero ($\Delta G^\circ > 0$).

94. The crystal system of a compound with unit cell dimensions $a = 0.387$, $b = 0.387$ and $c = 0.504$ nm and $\alpha = \beta = 90°$ and $\gamma = 120°$ is
(a) cubic (b) hexagonal
(c) orthorhombic (d) rhombohedral.

95. What is the pH of 0.01 M glycine solution? For glycine, $Ka_1 = 4.5 \times 10^{-3}$ and $Ka_2 = 1.7 \times 10^{-10}$ at 298 K?
(a) 3.0 (b) 10.0
(c) 6.1 (d) 7.2

96. Of the following which change will shift the reaction towards the product?
$I_{2\,(g)} \rightleftharpoons 2I_{(g)}$, ΔH_r° (298 K) = +150 kJ
(a) increase in concentration of I
(b) decrease in concentration of I_2
(c) increase in temperature
(d) increase in total pressure.

97. Which of the following statements is true for the electrochemical Daniel cell?
(a) Electrons flow from copper electrode to zinc electrode.
(b) Current flows from zinc electrode to copper electrode.
(c) Cations move toward copper electrode.
(d) Cations move toward zinc electrode.

98. Which of the following is a biodegradable polymer?
(a) cellulose (b) polythene
(c) polyvinyl chloride (d) nylon-6.

99. The rate constant k, for the reaction
$N_2O_{5\,(g)} \rightarrow 2NO_{2\,(g)} + 1/2\ O_{2\,(g)}$
is $2.3 \times 10^{-2}\ s^{-1}$. Which equation given below describes the change of $[N_2O_5]$ with time? $[N_2O_5]_0$ and $[N_2O_5]_t$ correspond to concentration of N_2O_5 initially and at time t.
(a) $[N_2O_5]_t = [N_2O_5]_0 + kt$
(b) $[N_2O_5]_0 = [N_2O_5]_t e^{kt}$
(c) $\log[N_2O_5]_t = \log[N_2O_5]_0 + kt$
(d) $\ln\frac{[N_2O_5]_0}{[N_2O_5]_t} = kt$.

100. Ozone in stratosphere is depleted by
(a) CF_2Cl_2 (b) C_7F_{16}
(c) $C_6H_6Cl_6$ (d) C_6F_6.

Directions for Q. 101 to Q. 120 : *In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below*

it. Of the statements, mark the correct answer as

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(c) If assertion is true but reason is false

(d) If both assertion and reason are false.

101. *Assertion* : $HClO_4$ is a stronger acid than $HClO_3$.
Reason : Oxidation state of Cl in $HClO_4$ is +8 and in $HClO_3$ +5.

102. *Assertion* : The free gaseous Cr atom has six unpaired electrons.
Reason : Half-filled *s* orbital has greater stability.

103. *Assertion* : The $[Ni(en)_3]Cl_2$ (en = ethylene diamine) has lower stability than $[Ni(NH_3)_6]Cl_2$.
Reason : In $[Ni(en)_3]Cl_2$ the geometry of Ni is trigonal bipyramidal.

104. *Assertion* : Sb (III) is not precipitated as sulphide when in its alkaline solution H_2S is passed.
Reason : The concentration of S^{2-} ion in alkaline medium is inadequate for precipitation.

105. *Assertion* : Nuclear binding energy per nucleon is in the order - $^{9}_{4}Be > {}^{7}_{3}Li > {}^{4}_{2}He$.
Reason : Binding energy per nucleon increases linearly with difference in number of neutrons and protons.

106. *Assertion* : Mg is not present in enamel of human teeth.
Reason : Mg is an essential element for biological functions of human.

107. *Assertion* : Carboxypeptidase is an exopeptidase.
Reason : It cleaves the N-terminal bond.

108. *Assertion* : Sucrose is a non-reducing sugar.
Reason : It has glycosidic linkage.

109. *Assertion* : Isobutanal does not give iodoform test.
Reason : It does not have α-hydrogen.

110. *Assertion* : Styrene on reaction with HBr gives 2-bromo-2-phenylethane.
Reason : Benzyl radical is more stable than alkyl radical.

111. *Assertion* : The pK_a of acetic acid is lower than that of phenol.
Reason : Phenoxide ion is more resonance stabilised.

112. *Assertion* : 2-bromobutane on reaction with sodium ethoxide in ethanol gives 1-butene as a major product.
Reason : 1-butene is more stable than 2-butene.

113. *Assertion* : The major products formed by heating $C_6H_5CH_2OCH_3$ with HI are $C_6H_5CH_2I$ and CH_3OH.
Reason : Benzyl cation is more stable than methyl cation.

114. *Assertion* : Molar entropy of vaporisation of water is different from ethanol.
Reason : Water is more polar than ethanol.

115. *Assertion* : Aqueous gold colloidal solution is red in colour.
Reason : The colour arises due to scattering of light by colloidal gold particles.

116. *Assertion* : Copper metal gets readily corroded is an acidic aqueous solution.
Reason : Free energy change for this process is positive.

117. *Assertion* : Addition of silver ions to a mixture of aqueous sodium chloride and sodium bromide solution will first precipitate AgBr rather than AgCl.
Reason : K_{sp} of AgCl < K_{sp} of AgBr

118. *Assertion* : Alcohols are dehydrated to hydrocarbons in the presence of acidic zeolites.
Reason : Zeolites are porous catalysts.

119. *Assertion* : All F – S – F angle in SF_4 is greater than 90° but less than 180°.
Reason : The lone pair-bond pair repulsion is weaker than bond pair-bond pair repulsion.

120. *Assertion* : Effusion rate of oxygen is smaller than nitrogen.
Reason : Molecular size of nitrogen is smaller than oxygen.

BIOLOGY

121. Cultivation of Bt cotton has been much in the news. The prefix Bt means
(a) "Barium-treated" cotton seeds

(b) "Bigger thread" variety of cotton with better tensile strength
(c) produced by "biotechnology" using restriction enzymes and ligases
(d) carrying an endotoxin gene from *Bacillus thuringienesis*.

122. Which one feature is common to leech, cockroach and scorpion?
(a) nephridia (b) ventral nerve cord
(c) cephalization (d) antennae.

123. Unidirectional transmission of a nerve impulse through nerve fibre is due to the fact that
(a) nerve fibre is insulated by a medullary sheath
(b) sodium pump starts operating only at the cyton and then continues into the nerve fibre
(c) neurotransmitters are released by dendrites and not by axon endings
(d) neurotransmitters are released by the axon endings and not by dendrites.

124. The total number of nitrogenous bases in human genome is estimated to be about
(a) 3.5 million (b) 35 thousand
(c) 35 million (d) 3.1 billion.

125. The Great Barrier Reef along the east coast of Australia can be categorised as
(a) population (b) community
(c) ecosystem (d) biome.

126. Which one of the following is a pair of endangered species?
(a) Garden lizard and Mexican poppy
(b) Rhesus monkey and Sal tree
(c) Indian peacock and carrot grass
(d) Hornbill and Indian aconite.

127. Which one of the following is a matching pair of a drug and its category?
(a) amphetamines - stimulant
(b) lysergic acid dimethyl amide - narcotic
(c) heroin - psychotropic
(d) benzodiazepam - pain killer.

128. In which one of the following pairs the two items mean one and the same thing?
(a) malleus - anvil
(b) SA node - pacemaker
(c) leucocytes - lymphocytes
(d) haemophilia - blood cancer.

129. Which one of the following categories of organisms do not evolve oxygen during photosynthesis?
(a) red algae
(b) photosynthetic bacteria
(c) C_4 plants with Kranz anatomy
(d) blue green algae.

130. A baby has been born with a small tail. It is a case exhibiting
(a) retrogressive evolution
(b) mutation (c) atavism
(d) metamorphosis.

131. Which one of the following is correctly matched regarding an Institute and its location?
(a) National Institute of Virology - Pune
(b) National Institute of Communicable Diseases - Lucknow
(c) Central Drug Research Institute - Kasauli
(d) National Institute of Nutrition - Mumbai.

132. Electron beam therapy is a kind of radiation therapy to treat
(a) enlarged prostrate gland
(b) gall bladder stones by breaking them
(c) certain types of cancer
(d) kidney stones.

133. Severe Acute Respiratory Syndrome (SARS)
(a) is caused by a variant of *Pneumococcus pneumoniae*
(b) is caused by a variant of the common cold virus (corona virus)
(c) is an acute form of asthma
(d) affects non-vegetarians much faster than the vegetarians.

134. Cattle fed with spoilt hay of sweet clover which contains dicumarol
(a) are healthier due to a good diet
(b) catch infections easily
(c) may suffer vitamin K deficiency and prolonged bleeding
(d) may suffer from beri beri due to deficiency of B vitamins.

135. If the Bengal Tiger becomes extinct
(a) hyenas and wolves will become scars
(b) the wild areas will be safe for man and domestic

animals
(c) its gene pool will be lost for ever
(d) the populations of beautiful animals like deers will get stabilized.

136. Nitrogen oxides produced from the emission of automobiles and power plants, are the source of fine air borne particles which lead to
(a) photochemical smog
(b) dry acid deposition
(c) industrial smog
(d) wet acid deposition.

137. A lake with an inflow of domestic sewage rich in organic waste may result in
(a) drying of the lake very soon due to algal bloom
(b) an increased production of fish due to lot of nutrients
(c) death of fish due to lack of oxygen
(d) increased population of aquatic food web organisms.

138. Minamata disease was caused due to the consumption of
(a) sea food containing lot of cadmium
(b) fish contaminated with mercury
(c) oysters with lot of pesticide
(d) sea food contaminated with selenium.

139. An artificial pacemaker is implanted subcutaneously and connected to the heart in patients
(a) having 90% blockage of the three main coronary arteries
(b) having a very high blood pressure
(c) with irregularity in the heart rhythm
(d) suffering from arteriosclerosis.

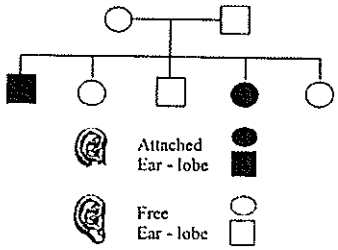
140. An example of gene therapy is
(a) production of injectable hepatitis B vaccine
(b) production of vaccines in food crops like potatoes which can be eaten
(c) introduction of gene for adenosine deaminase in persons suffering from Severe Combined Immuno-deficiency (SCID)
(d) production of test tube babies by artificial insemination and implantation of fertilized eggs.

141. The pollen tube usually enters the embryo sac
(a) through one of the synergids
(b) by directly penetrating the egg
(c) between one synergid and central cell
(d) by knocking off the antipodal cells.

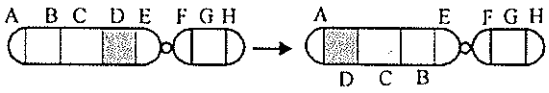
142. What is the first step in the Southern Blot technique?
(a) denaturation of DNA on the gel for hybridization with specific probe
(b) production of a group of genetically identical cells
(c) digestion of DNA by restriction enzyme
(d) isolation of DNA from a nucleated cell such as the one from the scene of crime.

143. Women who consumed the drug thalidomide for relief from vomiting during early months of pregnancy gave birth to children with
(a) no spleen (b) hare-lip
(c) extra fingers and toes
(d) underdeveloped limbs.

144. Given below is a pedigree chart of a family with five children. It shows the inheritance of attached ear-lobes as opposed to the free ones. The squares represent the male individuals and circles the female individuals.
Which one of the following conclusions drawn is correct?
(a) the parents are homozygous recessive
(b) the trait is Y-linked
(c) the parents are homozygous dominant
(d) the parents are heterozygous.



145. Given below is a representation of a kind of chromosomal mutation. What is the kind of mutation represented?



(a) deletion
(b) duplication
(c) inversion
(d) reciprocal translocation.

146. Which one of the following pairs is correctly matched with regard to the codon and the amino acid coded by it?
(a) UUA - valine (b) AAA - lysine
(c) AUG - cysteine (d) CCC - alanine.

147. The treatment of snake-bite by antivenine is an example of
(a) artificially acquired active immunity
(b) artificially acquired passive immunity
(c) naturally acquired passive immunity
(d) specific natural immunity.

148. The bacteria *Pseudomonas* is useful because of its ability to
(a) transfer genes from one plant to another
(b) decompose a variety of organic compounds
(c) fix atmospheric nitrogen in the soil
(d) produce a wide variety of antibiotics.

149. DNA is present in
(a) chromosomes and dictyosomes
(b) chloroplasts and lysosomes
(c) mitochondria and chloroplasts
(d) mitochondria and endoplasmic reticulum.

150. Pruning of plants promotes branching because the axillary buds get sensitized to
(a) ethylene (b) gibberellin
(c) cytokinin (d) indole acetic acid.

151. The sugarcane plant has
(a) dumb-bell shaped guard cells
(b) pentamerous flowers
(c) reticulate venation (d) capsular fruits.

152. Potato and sweet potato
(a) have edible parts which are homologous organs
(b) have edible parts which are analogous organs
(c) have been introduced in India from the same place
(d) are two species of the same genus.

153. In *Ulothrix* meiosis takes place in
(a) cells of the filament
(b) holdfast (c) zygote
(d) zoospores.

154. In a plant organ which is covered by periderm and in which the stomata are absent, some gaseous exchange still takes place through
(a) aerenchyma (b) trichomes
(c) pneumatophores (d) lenticels.

155. Somaclonal variation can be obtained by
(a) application of colchicine
(b) irradiation with gamma rays
(c) tissue culture (d) hybridisation.

156. If the high altitude birds become rare or extinct, the plants which may disappear along with them are
(a) pine (b) oak
(c) orchids (d) rhododendrons.

157. Companion cells in plants are associated with
(a) vessels (b) sperms
(c) sieve elements (d) guard cells.

158. Mossess and ferns are found in moist and shady places because both
(a) require presence of water for fertilization
(b) do not need sunlight for photosynthesis
(c) depend for their nutrition on microorganisms which can survive only at low temperature
(d) cannot compete with sun-loving plants.

159. Cork cambium results in the formation of cork which becomes impermeable to water due to the accumulation of
(a) resins (b) suberin
(c) lignins (d) tannins.

160. How many different types of gametes can be formed by F_1 progeny, resulting from the following cross:
AA BB CC × aa bb cc
(a) 3 (b) 8
(c) 27 (d) 64.

Directions for Q. 161 to Q. 180 : *In each of the following questions, a statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as*
(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion
(c) If Assertion is true but Reason is false
(d) If both Assertion and Reason are false.

161. *Assertion* : Agricultural output increased several times after introduction of DDT.
Reason : DDT was the first insecticide used on a wide scale.

162. *Assertion* : Diabetes insipidus is marked by excessive urination and too much thirst of water.

Reason : Anti-diuretic hormone (ADH) is secreted by the posterior lobe of pituitary gland.

163. *Assertion* : Coacervates are believed to be the precursors of life.
Reason : Coacervates were self-duplicating aggregates of proteins surrounded by lipid molecules.

164. *Assertion* : Tapeworm, roundworm and pinworm are endoparasites of human intestine.
Reason : Improperly cooked food is the source of all intestinal infections.

165. *Assertion* : Fish meal is a rich source of protein for cattle and poultry.
Reason : Fish meal is produced from non-edible parts of fishes like fins, tail etc.

166. *Assertion* : Animals adopt different strategies to survive in hostile environment.
Reason : Praying mantis is green in colour which merges with plant foliage.

167. *Assertion* : Among the primates, chimpanzee is the closest relative of the present day humans.
Reason : The banding pattern in the autosome numbers 3 and 6 of man and chimpanzee is remarkably similar.

168. *Assertion* : Dope test is used to estimate the level of blood alcohol by analysing the breath of persons drinking alcohol.
Reason : A drunken person usually feels tense and less talkative.

169. *Assertion* : The honey bee queen copulates only once in her life time.
Reason : The honey bee queen can lay fertilized as well as unfertilized eggs.

170. *Assertion* : From evolutionary point of view, human gestation period is believed to be shortening.
Reason : One major evolutionary trend in humans has been the larger head undergoing relatively faster growth rate in the foetal stage.

171. *Assertion* : Natural selection is the outcome of differences in survival and reproduction among individuals that show variation in one or more traits.
Reason : Adaptive forms of a given trait tend to become more common; less adaptive ones become less common or disappear.

172. *Assertion* : Ginger has a prostrate-growing rhizome.
Reason : Shoot growth is not effected by gravity.

173. *Assertion* : Photomodulation of flowering is a phytochrome - regulated process.
Reason : Active form of phytochrome (Pfr) directly induces floral induction in shoot buds.

174. *Assertion* : Cyclic pathway of photosynthesis first appeared in some eubacterial species.
Reason : Oxygen started accumulating in the atmosphere after the non-cyclic pathway of photosynthesis evolved.

175. *Assertion* : Nitrogen-fixing bacteria in legume root nodules survive in oxygen-depleted cells of nodules.
Reason : Legheamoglobin completely removes oxygen from the nodule cells.

176. *Assertion* : Red algae contribute in producing coral reefs.
Reason : Some red algae secrete and deposit calcium carbonate over their walls.

177. *Assertion* : Insects visit flowers to gather honey.
Reason : Attraction of flowers prevents the insects from damaging other parts of the plant.

178. *Assertion* : Coconut tree is distributed in coastal areas over a large part of the world.
Reason : Coconut fruit can float and get dispersed over thousands of kilometers before losing viability.

179. *Assertion* : Deficiency of sulphur causes chlorosis in plants.
Reason : Sulphur is a constituent of chlorophyll, proteins and nucleic acids.

180. *Assertion* : Cattle breeds can be improved by superovulation and embryo transplantation.
Reason : Superovulation in high milk-yielding cows is induced by hormonal injection.

GENERAL KNOWLEDGE

181. Birbal Sahni was a
(a) zoologist
(b) founder of Central Drug Research Institute
(c) ornithologist (d) paleobotanist.

182. In the year (2003) the chemistry Nobel Prize was awarded to the following work.
(a) aquaporins (b) Na^{++} channels
(c) Ca^{++} channels (d) methyl chavicol.

183. It lives underwater for up to three years as nymph before emerging as a flying insect. Fossils of this

insect dating back about 300 million years have been found.
(a) scorpion fly (b) stone fly
(c) caddis fly (d) may fly.

184. A man-made tunnel in India transfers water from which one river to another?
(a) Narmada to Tapti (b) Betwa to Sone
(c) Beas to Sutlej
(d) Godawari to Krishna.

185. The great Fisher Bank is situated off
(a) the coast of New Foundland
(b) the Chilean coast (c) the Spanish coast
(d) the coast of Great Britain.

186. Which one of the following organisation's iron and steel plant was built to use charcoal as a source of power, to start with, but later switched over to hydroelectricity?
(a) the Tata Iron Steel Company
(b) the Indian Iron and Steel Company
(c) Mysore Iron and Steel Company
(d) Hindustan Steel Limited.

187. Rishikesh is famous for the production of
(a) antibiotics (b) heavy electricals
(c) fertilizers (d) transistorized radios.

188. Rayon fibre is manufactured from
(a) petroleum (b) wood and pulp
(c) chemicals (d) naphtha.

189. Nepanagar is famous for
(a) paper board industries
(b) craft paper industries
(c) carbon paper industries
(d) newsprint paper industries.

190. Since the Britishers wanted India to produce and supply raw materials to feed English factories, they pushed a policy that encouraged cultivation of
(a) jute (b) indigo
(c) cotton (d) commercial crops.

191. Primary sector refers to
(a) industry (b) agriculture
(c) trade (d) banks.

192. Recently there was a report on adverse effect of wearing neck tie. Tight neck tie may cause
(a) glaucoma (b) hypertension
(c) hoarseness of voice (d) hyperthyroidism.

193. The noise produced in office is normally at the level of
(a) 20 db (b) 30 db
(c) 40 db (d) 60 db.

194. In the year 2003 in an eco-marathon contest in Hiroshima the 'Fancy Carol' recorded the mileage of distance per litre of petrol as
(a) 396 km/litre (b) 936 km/litre
(c) 1962 km/litre (d) 3962 km/litre.

195. Dravida Munnetra Kazhakam (DMK) was founded by
(a) M.G. Ramachandran
(b) C.N. Annadurai
(c) Kumar Swami Kamraj
(d) Lalithambika Antharjanam.

196. All of the following won the title of 'Miss World' except
(a) Lara Dutta (b) Aishwarya Rai
(c) Yukta Mukhi (d) Priyanka Chopra.

197. Where is 'Indira Gandhi Rashtriya Uran Akadimi' situated?
(a) Dehradun (b) Raebareli
(c) Allahabad (d) Mussorrie.

198. All of the following are correct about 'Media Lab' except
(a) the third media lab is situated in India
(b) it is supported by government funding
(c) it is interdisciplinary *i.e.* involves sociologists, economists, computer sciences etc.
(d) it plans to produce wearable computer.

199. In the year 2003 which of the following Indian American was honoured by President Bush for his research in automotive technology?
(a) Hiren Gandhi (b) Sabeer Bhatia
(c) Guraj Deshpande (d) Vinod Khosla.

200. Who of the following was a medical doctor?
(a) Samuel Taylor Coleridge
(b) John Webster (c) Somerset Maugham
(d) Thomas Gray.

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