1. A wire mesh consisting of very small squares is viewed at a distance of 8 cm through a magnifying converging lens of focal length 10 cm, kept close to the eye. The magnification produced by the lens is :
   (a) 5 (b) 8
   (c) 10 (d) 20

2. Hard X-rays for the study of fractures in bones should have a minimum wavelength of 10^{-11} m. The accelerating voltage for electrons in X-ray machine should be :
   (a) < 124 kV
   (b) > 124 kV
   (c) between 60 kV and 70 kV
   (d) = 100 kV

3. In photoelectric effect, the electrons are ejected from metals if the incident light has a certain minimum :
   (a) wavelength (b) frequency
   (c) amplitude (d) angle of incidence

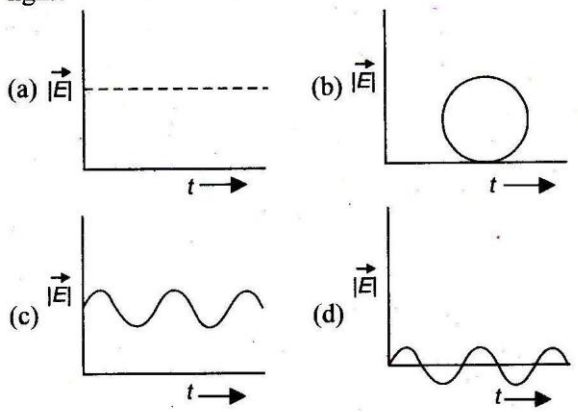
4. A lens is made of flint glass (refractive index = 1.5). When the lens is immersed in a liquid of refractive index 1.25, the focal length :
   (a) increases by a factor of 1.25
   (b) increases by a factor of 2.5
   (c) increases by a factor of 1.2
   (d) decreases by a factor of 1.2

5. The voltage of clouds is 4×10^6 V with respect to ground. In a lightning strike lasting 100 ms, a charge of 4 C is delivered to the ground. The power of lightning strike is :
   (a) 160 MW (b) 80 MW
   (c) 20 MW (d) 500 kW

6. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distance of 2 m and 3 m respectively from the source. The ratio of the intensities of the waves at P and Q is :
   (a) 9 : 4 (b) 2 : 3
   (c) 3 : 2 (d) 4 : 9

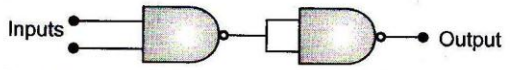
7. When a p-n junction diode is reverse biased, then:
   (a) no current flows
   (b) the depletion region is increased
   (c) the depletion region is reduced
   (d) the height of the potential barrier is reduced

8. Which of the following diagrams represent the variation of electric field vector with time for a circularly polarised light?



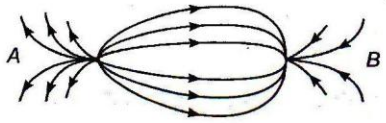
9. The operation of a nuclear reactor is said to be critical, if the multiplication factor (k) has a value :
   (a) 1 (b) 1.5
   (c) 2.1 (d) 2.5

10. The circuit given below represents which of the logic operations?



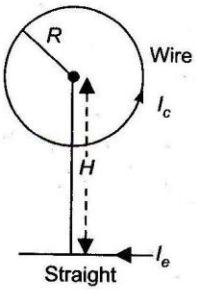
(a) AND (b) NOT
(c) OR (d) NOR

11. The spatial distribution of the electric field due to charges (A, B) is shown in figure. Which one of the following statements is correct?



(a) A is +ve and B –ve and $|A| > |B|$
(b) A is –ve and B +ve ; $|A| = |B|$
(c) Both are +ve but $A > B$
(d) Both are –ve but $A > B$

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



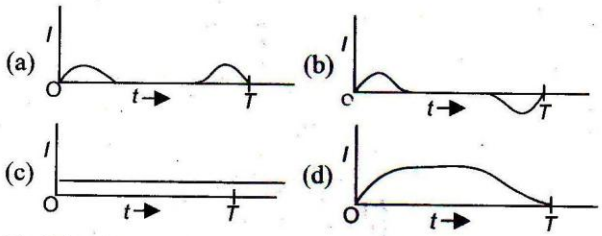
(a) $\frac{I_e R}{I_c \pi}$ (b) $\frac{I_c R}{I_e \pi}$
(c) $\frac{\pi I_c}{I_e R}$ (d) $\frac{I_e \pi}{I_c R}$

13. $^{238}_{92}U$ has 92 protons and 238 nucleons. It decays by emitting an alpha particle and becomes :
(a) $^{234}_{92}U$ (b) $^{234}_{90}Th$
(c) $^{235}_{92}U$ (d) $^{237}_{93}Np$

14. The fossil bone has a ^{14}C : ^{12}C ratio, which is $\left[\frac{1}{16}\right]$ of that in a living animal bone. If the half-life of ^{14}C is 5730 years, then the age of the fossil bone is :
(a) 11460 years (b) 17190 years
(c) 22920 years (d) 45840 years

15. Which one of the following is a possible nuclear reaction?
(a) $^{10}_{5}B + ^{4}_{2}He \longrightarrow ^{13}_{7}N + ^{1}_{1}H$
(b) $^{23}_{11}Na + ^{1}_{1}H \longrightarrow ^{20}_{10}Ne + ^{4}_{2}He$
(c) $^{239}_{93}NP \longrightarrow ^{239}_{94}Pu + \beta^- + \bar{\nu}$
(d) $^{11}_{7}N + ^{1}_{1}H \longrightarrow ^{12}_{6}C + \beta^- + \nu$

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



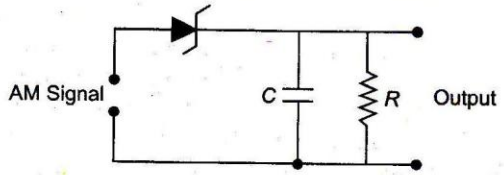
17. If alpha, beta and gamma rays carry same momentum, which has the longest wavelength?
(a) Alpha rays
(b) Beta rays
(c) Gamma rays
(d) None, all have same wavelength

18. An amplifier has a voltage gain $A_v = 1000$. The voltage gain in dB is :
(a) 30 dB (b) 60 dB
(c) 3 dB (d) 20 dB

19. A light emitting diode (LED) has a voltage drop of 2 V across it and passes a current of 10 mA. When it operates with a 6 V battery through a limiting resistor R. The value of R is :
(a) 40 kΩ (b) 4 kΩ
(c) 200 Ω (d) 400 Ω

20. The minimum potential difference between the base and emitter required to switch a silicon transistor 'ON' is approximately :
(a) 1 V (b) 3 V
(c) 5 V (d) 4.2 V

21. Given below is a circuit diagram of an AM demodulator.



For good demodulation of AM signal of carrier frequency f, the value of RC should be :
(a) $RC = \frac{1}{f}$ (b) $RC < \frac{1}{f}$
(c) $RC \geq \frac{1}{f}$ (d) $RC >> \frac{1}{f}$

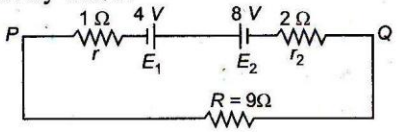
22. A closely wound solenoid of 2000 turns and area of cross-section 1.5×10^{-4} m^2 carries a current of 2.0 A. It is suspended through its centre and perpendicular to its length, allowing it to turn in a horizontal plane in a uniform magnetic field 5×10^{-2} T, making an angle of 30° with the axis of the solenoid. The torque on the solenoid will be
(a) 3×10^{-3} N-m (b) 1.5×10^{-3} N-m
(c) 1.5×10^{-2} N-m (d) 3×10^{-2} N-m

23. A freshly prepared radioactive source of half–life 2 h emits radiation of intensity which is 64 times the permissible safe level. Calculate, the minimum time after which it would be possible to work safely with this source.

(a) 12 h (b) 24 h

(c) 6 h (d) 130 h

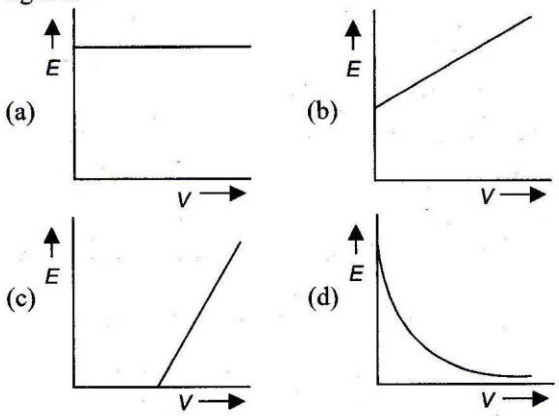
24. Two batteries of emf 4 V and 8 V with internal resistance 1Ω and 2Ω respectively are connected to an external resistance R = 9Ω as shown in figure. The current in circuit and the potential difference between P and Q respectively will be



(a) $\frac{1}{2}$ A, 9 V (b) $\frac{1}{12}$ A, 12 V

(c) $\frac{1}{3}$ A, 3 V (d) $\frac{1}{6}$ A, 4 V

25. The correct graph respectively the relation between energy (E) of photoelectrons and frequency v of incident light is



26. The transfer ratio p of a transistor is 50. The input resistance of the transistor, when used in the common emitter mode is 1 kΩ. The peak value of the collector alternating current for an input peak voltage of 0.01 V is

(a) 0.25 μA (b) 0.01 μA

(c) 500 μA (d) 100 μA

27. A charge q is located at the centre of a cube. The electric flux through any face is

(a) $\frac{\pi q}{6(4\pi\varepsilon_0)}$ (b) $\frac{q}{6(4\pi\varepsilon_0)}$

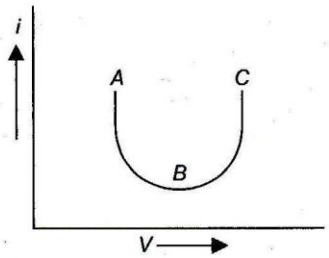
(c) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$ (d) $\frac{4\pi q}{6(4\pi\varepsilon_0)}$

28. A charged spherical conductor of radius a and charge q, is surrounded by another charged concentric sphere of radius $b(b > a)$. The potential difference between conductors is V. When, the spherical conductor of radius b is discharged completely, then the potential difference between conductor will be

(a) V (b) $\frac{V_a}{b}$

(c) $\frac{q_1}{4\pi\varepsilon_0 a} - \frac{q_2}{4\pi\varepsilon_0 b}$ (d) None of the above

29. The current-voltage graph for a device is shown in figure. The resistance is negative in region.



(a) AB (b) BC

(c) ABC (d) None of these

30. A magnet is cut in three equal parts by cutting it perpendicular to its length. The time period of original magnet is T_0 in a uniform magnetic field B. Then, the time period of each part in the same magnetic field is

(a) $\frac{T_0}{2}$ (b) $\frac{T_0}{3}$

(c) $\frac{T_0}{4}$ (d) None of these

31. A 50 Hz AC current of crest value 1 A flows through the primary of a transformer. If the mutual inductance between the primary and secondary be 0.5 H, the crest voltage induced in the secondary is

(a) 75 V (b) 150 V

(c) 100 V (d) None of these

32. If the length and area of cross-section of a conductor are doubled, then its resistance will be

(a) unchanged (b) halved

(c) doubled (d) quadrupled

33. A ruby laser produces radiations of wavelengths, 662.6 nm in pulse whose duration are 10^{-9} s. If the laser produces 0.39 J of energy per pulse, how many photons are produced in each pulse?

(a) 1.3×10^{9} (b) 1.3×10^{18}

(c) 1.3×10^{27} (d) 3.9×10^{18}

34. Balmer gives an equation for wavelength of visible radiation of H^- spectrum as $\lambda = \frac{kn^2}{n^2 - 4}$. The value of k in terms of Rydberg's constant R is

(a) R (b) $4R$

(c) $R/4$ (d) $4/R$

35. The KE of the electron in an orbit of radius r in hydrogen atom is (e = electronic charge)

(a) $\frac{e^2}{r}$ (b) $\frac{e^2}{2r}$

(c) $\frac{e^2}{r^2}$ (d) $\frac{e^2}{2r^2}$

36. Three charged particles are collinear and are in equilibrium, then

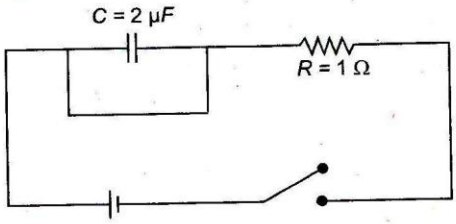
(a) all the charged particles have the same polarity

(b) the equilibrium is unstable

(c) all the charged particles cannot have the same polarity

(d) Both (b) and (c) are correct

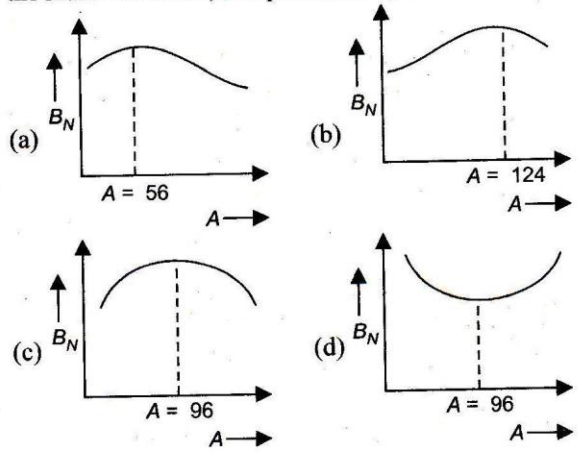
37. The capacitive time constant of the RC circuit shown in the figure is



(a) zero (b) infinity

(c) 2s (d) 2 μs

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



39. 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

40. The speed of an electron haying wavelength of 10^{-10} m is:

(a) 4.24×10^6 m/s (b) 5.25×10^6 m/s

(c) 6.25×10^6 m/s (d) 7.25×10^6 m/s

Directions for Q. 41 to Q.45: In each of the following questions a statement of Assertion is followed by a corresponding statement of Reason. 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 statement but reason is false.

(d) If both assertion and reason are false.

41. Assertion: The binding energy per nucleon, for nuclei with atomic mass number $A > 100$, decreases with A.

Reason: The nuclear forces are weak for heavier nuclei.

42. Assertion: In common base configuration, the current gain of the transistor is less than unity.

Reason: The collector terminal is reverse biased for amplification.

43. Assertion: Standard optical diffraction can not beusedfordiscriminating between different X-ray wavelengths.

Reason: The grating spacing is not of the order of X-ray wavelengths.

44. Assertion: Diamagnetic materials can exhibit magnetism.

Reason: Diamagnetic materials have permanent magnetic dipole moment.

45. Assertion: In the phenomenon of mutual induction, self–induction of each of the coil persists.

Reason: Self–induction arises when strength of current in one coil changes. In mutual induction current is changing in both the individual coils.

SECTION 2 - CHEMISTRY

46. An acidic solution of 'X' does not give precipitate on passing H_2S through it. 'X' gives white precipitate when NH_4OH is added to it. The white precipitate dissolves in excess of NaOH solution. Pure 'X' fumes in air and dense white fumes are obtained when a glass rod dipped in NH_4OH is put in the fumes. Compound 'X' can be
(a) $ZnCl_2$ (b) $FeCl_3$
(c) $AlCl_3$ (d) $SnCl_2$

47. CN^- is a strong field ligand. This is due to the fact that:
(a) it carries negative charge
(b) it is a pseudohalide
(c) it can accept electrons from metal species
(d) it forms high spin complexes with metal species

48. The weight of NaCl decomposed by 4.9g of H_2SO_4, if 6 g of sodium hydrogen sulphate and 1.825 g of HCl, were produced in the reaction is:
(a) 6.921 g (b) 4.65 g
(c) 2.925 g (d) 1.4 g

49. Which one of the following statement is not true ?
(a) pH of drinking water should be between 5.5 – 9.5.
(b) Concentration of DO below 6 ppm is good for the growth of fish.
(c) Clean water would have a BOD value of less than 5 ppm.
(d) Oxides of sulphur, nitrogen and carbon are the most widespread air pollutant.

50. Which of the following statements is not correct for nitrogen ?
(a) Its electronegativity is very high
(b) d-orbitals are available for bonding
(c) It is a typical non-metal
(d) Its molecular size is small

51. Heat of dissociation of CH_3COOH is 0.005 kcal g^{-1}, hence enthalpy change when 1 mol of $Ca(OH)_2$ is completely neutralised by CH_3COOH is
(a) −27.4 kcal (b) −13.6 kcal
(c) −26.8 kcal (d) −27.1 kcal

52. 0.4 moles of HCl and 0.2 moles of $CaCl_2$ were dissolved in water to have 500 mL of solution, the molarity of Cl^- ion is:
(a) 0.8 M (b) 1.6 M
(c) 1.2 M (d) 10.0 M

53. In sodium fusion test of organic compounds, the nitrogen of the organic compound is converted into
(a) Sodamide (b) Sodium cyanide
(c) Sodium nitrite (d) Sodium nitrate

54. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/gm. whose radius and length 7 Å & 10 Å respectively. If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus
(a) 3.08×10^3 kg/mol (b) 3.08×10^4 kg/mol
(c) 1.54×10^4 kg/mol (d) 15.4 kg/mol

55. Inductive effect involves
(a) displacement of σ-electrons
(b) delocalisation of π-electrons
(c) delocalisation of σ-electrons
(d) displacement of π-electrons

56. The energy of a photon is 3×10^{-12} erg. What is its wavelength in nm ?
($h = 6.62 \times 10^{-27}$ erg-sec; $c = 3 \times 10^{10}$ cm/s)
(a) 662 (b) 1324
(c) 66.2 (d) 6.62

57. The decreasing order of stability of alkyl carbonium ion is in the order of :

(a) $R-\overset{R}{\underset{R}{C^+}} > R-\overset{R}{\underset{H}{C^+}} > R-\overset{H}{\underset{H}{C^+}} > H-\overset{H}{\underset{H}{C^+}}$

(b) $H-\overset{H}{\underset{H}{C^+}} > R-\overset{H}{\underset{H}{C^+}} > R-\overset{R}{\underset{H}{C^+}} > R-\overset{R}{\underset{R}{C^+}}$

(c) $R-\overset{R}{\underset{H}{C^+}} > R-\overset{R}{\underset{R}{C^+}} > R-\overset{H}{\underset{H}{C^+}} > H-\overset{H}{\underset{H}{C}}$

(d) $R-\overset{H}{\underset{H}{C^+}} > R-\overset{R}{\underset{H}{C^+}} > R-\overset{R}{\underset{R}{C^+}} > H-\overset{H}{\underset{H}{C}}$

58. Aluminium vessels should not be washed with materials containing washing soda since
(a) washing soda is expensive
(b) washing soda is easily decomposed
(c) washing soda reacts with Al to form soluble aluminate
(d) washing soda reacts with Al to form insoluble aluminium oxide

59. The following data are for the decomposition of ammonium nitrite in aqueous solution :

Vol. of N_2 in cc	Time (min)
6.25	10
9.00	15
11.40	20
13.65	25
35.65	Infinity

The order of rection is :
(a) Zero (b) One
(c) Two (d) Three

60. Which of the following reagents convert propene to 1-propanol?
(a) H_2O, H_2SO_4
(b) aqueous KOH
(c) $MgSO_4, NaBH_4/H_2O$
(d) B_2H_6, H_2O_2, OH^-

61. A closed container contains equal number of oxygen and hydrogen molecules at a total pressure of 740 mm. If oxygen is removed form the system then pressure will
(a) Become double of 740 mm
(b) Become half of 740 mm
(c) Become 1/9 of 740 mm
(d) Remains unchanged

62. Compound X of molecular formula C_4H_6 takes up one equivalent of hydrogen in presence of Pt to form another compound Y which on ozonolysis gives only ethanoic acid. The compound X can be
(a) $CH_2 = CH - CH = CH_2$
(b) $CH_2 = C = CHCH_3$
(c) $CH_3C \equiv CCH_3$
(d) All the three

63. 1 M solution of CH_3COOH should be diluted to ..... times so that pH is doubled.
(a) four times (b) 5.55×10^4 times
(c) 5.55×10^6 times (d) 10^{-2} times

64. The following reactions take place in the blast furnace in the preparation of impure iron. Identify the reaction pertaining to the formation of the slag.
(a) $Fe_2O_3(s) + 3\,CO(g) \rightarrow 2\,Fe\,(l) + 3\,CO_2\,(g)$
(b) $CaCO_3\,(s) \rightarrow CaO\,(s) + CO_2\,(g)$
(c) $CaO\,(s) + SiO_2(s) \rightarrow CaSiO_3\,(s)$
(d) $2C(s) + O_2\,(g) \rightarrow 2\,CO(g)$

65. Which one of the following is NOT a buffer solution?
(a) $0.8\,M\,H_2S + 0.8\,M\,KHS$
(b) $2MC_6H_5NH_2 + 2MC_6H_5\overset{+}{N}H_3Br^-$
(c) $3MH_2CO_3 + 3MKHCO_3$
(d) $0.05\,M\,KClO_4 + 0.05\,M\,HClO_4$

66. Which of the following statements is false ?
(a) Radon is obtained from the decay of radium
(b) Helium is inert gas
(c) Xenon is the most reactive among the rare gases
(d) The most abundant rare gas found in the atmosphere is helium

67. Which one of the following is expected to exhibit optical isomerism?
(en = ethylenediamine)
(a) cis-$[Pt(NH3)_2Cl_2]$
(b) trans-$[Pt(NH_3)_2Cl_2]$
(c) cis-$[Co(en)_2Cl_2]$
(d) trans-$[Co(en)_2Cl_2]$

68. For the reaction,
$$2N_2O_5 \longrightarrow 4NO_2 + O_2$$
the rate of reaction is :
(a) $\frac{1}{2}\frac{d}{dt}[N_2O_5]$ (b) $2\frac{d}{dt}[N_2O_5]$
(c) $\frac{1}{4}\frac{d}{dt}[NO_2]$ (d) $4\frac{d}{dt}[NO_2]$

69. Four successive members of the first row transition elements are listed below with their atomic numbers. Which one of them is expected to have the highest third ionization enthalpy?
(a) Vanadium (Z = 23)
(b) Chromium (Z = 24)
(c) Manganese (Z = 25)
(d) Iron (Z = 26)

70. $[Cr(H_2O)_6]Cl_3$ (at no. of Cr = 24) has a magnetic moment of 3.83 B. M. The correct distribution of 3d electrons in the Chromium of the complex is
(a) $3d_{xy}^1, (3d_{x^2-y^2})^1, 3d_{yz}^1$
(b) $3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1$
(c) $3d_{xy}^1, 3d_{yz}^1, 3d_{dz^2}$
(d) $(3d_{x^2-y^2})^1, 3d_{z^2}, 3d_{xz}^1$

71. In the balanced chemical reaction
$$IO_3^- + aI^- + bH^+ \longrightarrow cH_2O + dI_2$$
a, b, c and d respectively corresponds to
(a) 5, 6, 3, 3 (b) 5, 3, 6, 3
(c) 3, 5, 3, 6 (d) 5, 6, 5, 5

72. Which of the following statements is true?
(a) Silicon exhibits 4 coordination number in its compound
(b) Bond energy of F_2 is less than Cl_2
(c) Mn(III) oxidation state is more stable than Mn(II) in aqueous state
(d) Elements of 15th group shows only +3 and +5 oxidation states

73. Which of the following compounds has the highest boiling point?
(a) $CH_3CH_2CH_2Cl$
(b) $CH_3CH_2CH_2CH_2Cl$
(c) $CH_3CH(CH_3)CH_2Cl$
(d) $(CH_3)_3CCl$

74. Which one of the following statements is not correct ?
(a) Nickel forms $Ni(CO)_4$
(b) All the transition metals form monometallic carbonyls
(c) Carbonyls are formed by transition metals
(d) Transition metals form complexes

75. Hydrogen has an ionisation energy of 1311 kJ mol^{-1} and for chlorine it is 1256 kJ mol^{-1}. Hydrogen forms H^+ (aq) ions but chlorine does not form Cl^+ (aq) ions because
(a) H^+ has lower hydration enthalpy
(b) Cl^+ has lower hydration enthalpy
(c) Cl has high electron affinity
(d) Cl has high electronegativity

76. The number of enantiomers of the compound $CH_3CHBrCHBrCOOH$ is :
(a) 2 (b) 3
(c) 4 (d) 6

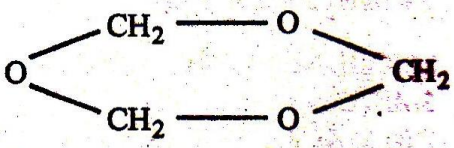
77. Equivalent weighs of $KMnO_4$ acidic medium, neutral medium and concentrated alkaline medium respectively are $\frac{M}{5}, \frac{M}{1}, \frac{M}{3}$. Reduced products can be
(a) $MnO_2, MnO_4^{2-}, Mn^{2+}$
(b) $MnO_2, Mn^{2+}, MnO_4^{2-}$
(c) $Mn^{2+}, MnO_4^{2-}, MnO_2$
(d) $Mn^{2+}, MnO_2, MnO_4^{2-}$

78. Which of these have no unit?
(a) Electronegativity
(b) Electron affinity
(c) Ionisation energy
(d) Excitation potential

79. Which of the following statements is not correct for sigma and pi-bonds formed between two carbon atoms?
(a) Sigma-bond determines the direction between carbon atoms but a pi-bond has no primary effect in this regard
(b) Sigma-bond is stronger than a pi-bond
(c) Bond energies of sigma- and pi-bonds are of the order of 264 kJ/mol and 347 kJ/mol, respectively
(d) Free rotation of atoms about a sigma-bond is allowed but not in case of a pi-bond

80. The reactivity of metals with water is in the order of
(a) Na > Mg > Zn > Fe > Cu
(b) Cu > Fe > Zn > Mg > Na
(c) Mg > Zn > Na > Fe > Cu
(d) Zn > Na > Mg > Fe > Cu

81. The emf of Daniell cell at 298 K is E_1
$Zn|ZnSO_4(0.01\ M)||CuSO_4(1.0\ M)|Cu$
When the concentration of $ZnSO_4$ is 1.0 M and that of $CuSO_4$ is 0.01 M, the emf changed to E_2
What is the relation between E_1 and E_2?
(a) $E_1 = E_2$ (b) $E_2 = 0 \neq E_2$
(c) $E_1 > E_2$ (d) $E_1 < E_2$

82. 

The above shown polymer is obtained when a carbonyl compound is allowed to stand. It is a white solid. The polymer is
(a) Trioxane (b) Formose
(c) Paraformaldehyde (d) Metaldehyde.

83. The correct order of atomic/ionic sizes is
(a) N < Li < B
(b) $F^- < O^{2-} < N^{3-}$
(c) $Ca^{2+} < S^{2-} < Cl^-$
(d) $Na^+ < Mg^{2+} < Cl^-$

84. The rapid change of pH near the stoichiometric point of an acid-base titration is the basis of indicator detection. pH of the solution is related to ratio of the concentrations of the conjugate acid (HIn) and base (In^-) forms of the indicator by the expression
(a) $\log\frac{[In^-]}{[HIn]} = pK_{In} - pH$
(b) $\log\frac{[HIn]}{[In^-]} = pK_{In} - pH$
(c) $\log\frac{[HIn]}{[In^-]} = pH - pK_{In}$
(d) $\log\frac{[In^-]}{[HIn]} = pH - pK_{In}$

85. In the diazotization of arylamines with sodium nitrite and hydrochloric acid, an excess of hydrochloric acid is used primarily to
(a) Supress the concentration of free aniline available for coupling
(b) Supress hydrolysis of phenol
(c) Ensure a stoichiometric amount of nitrous acid
(d) Neutralise the base liberated

86. In lake test of Al^{3+} ion, there is formation of coloured floating lake. It is due to
(a) adsorption of litmus by H_2O
(b) adsorption of litmus by $Al(OH)_3$
(c) adsorption of litmus by $Al(OH)_4^-$
(d) none of these

87. An ideal gas expands in volume from 1×10^{-3} to $1\times10^{-2}\ m^3$ at 300 K against a constant pressure of $1\times10^5\ Nm^{-2}$. The work done is
(a) 270 kJ (b) −900 kJ
(c) −900 J (d) 900 kJ

88. Ethanol and dimethyl ether form a pair of functional isomers. The boiling point of ethanol is higher than that of dimethyl ether, due to the presence of
(a) H-bonding in ethanol
(b) H-bonding in dimethyl ether
(c) CH_3 group in ethanol
(d) CH_3 group in dimethyl ether

89. Which of the following reactions will not result in the formation of anisole?
(a) Phenol + dimethyl sulphate in presence of a base
(b) Sodium phenoxide is treated with methyl iodide
(c) Reaction of diazomethane with phenol
(d) Reaction of methylmagnesium iodide with phenol

90. What will be the heat of formation of methane, if the heat of combustion of carbon is '–x' kJ, heat of formation of water is '–y' kJ and heat of combustion of methane is '–z' kJ ?
(a) (–x – y + z) kJ (b) (–z – x + 2y) kJ
(c) (–x – 2y – z) kJ (d) (–x – 2y + z) kJ

SECTION 3 - BOTANY

91. A taxon is
(a) a group of related families
(b) a group of related species
(c) a type of living organisms
(d) a taxonomic group of any ranking

92. Peat moss is another name of
(a) *Sphagnum* (b) *Marchantia*
(c) *Riccia* (d) *Dryopteris*

93. In fern, spores are formed in
(a) sporangium (b) oogonium
(c) archegonium (d) stomium

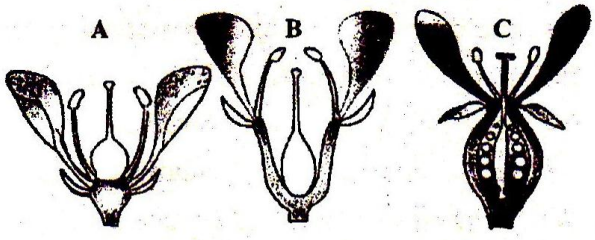
94. Which one of the following is a true fruit?
(a) Apple (b) Pear
(c) Cashew nut (d) Coconut

95. The cork cambium, cork and secondary cortex are collectively called
(a) phelloderm (b) phellogen
(c) periderm (d) phellem

96. Which of the following algae are suitable for human consumption?
(a) *Laminaria* and *Fucus*
(b) *Gracilaria* and *Chondrus*
(c) *Porphyra* and *Spirogyra*
(d) *Rhodymania* and *Porphyra*

97. Choose the correct option.
(i) Lysosomes are double membranous vesicles budded off from Golgi apparatus and contain digestive enzymes.
(ii) Endoplasmic reticulum consists of a network of membranous tubule and helps in transport, synthesis and secretion.
(iii) Leucoplasts are bound by two membranes, lack pigment but contain their own DNA and protein synthesising machinery.
(iv) Sphaerosomes are single membrane bound organelle which are associated with synthesis and storage of lipids.
(a) (i) only (b) (i) and (ii)
(c) (ii), (iii) and (iv) (d) All of these

98. Chosse the correct combinations.



I. Hypogynous flower
II. Perigynous flower
III. Epigynous flower

(a) A - I, B - II, C - III (b) A - I, B - III, C - II
(c) A - III, B - II, C - I (d) A - III, B - I, C - II

99. Which one of the following is not a method of vegetative propagation?
(a) Budding (b) Layering
(c) Sowing (d) Tissue culture

100. Entry of pollen tube through micropyle is
(a) Chalazogamy (b) Mesogamy
(c) Porogamy (d) Pseudogamy

101. Competition for light, nutrients and space is most severe between
(a) closely related organism growing in different habitats
(b) closely related organisms growing in the same habitat
(c) distantly related organisms growing in the same habitat
(d) distantly related organisms growing in different habitats

102. In oogamy, fertilization involves
(a) a small non-motile female gamete and a large motile male gamete
(b) a large non-motile female gamete and a small motile male gamete
(c) a large non-motile female gamete and a small nonmotile male gamete
(d) a large motile female gamete and a small nonmotile male gamete

103. Photochemical smog formed in congested metropolitan cities mainly consists of
(a) Ozone, peroxyacetyl nitrate and NO_X
(b) Smoke, peroxyacetyl nitrate and SO_2
(c) Hydrocarbon, SO_2 and CO_2
(d) Hydrocarbon, ozone and SO_X

104. The electrostatic precipitator is used for removing particulate matter from
(a) Exhaust of the thermal power plant
(b) Exhaust from the automobiles
(c) Industrial effluents
(d) Kitchen waste

105. Keystone species in an ecosystem are those
(a) present in maximum number
(b) that are most frequent
(c) attaining a large biomass
(d) contributing to ecosystem properties

106. Initiation codon of protein synthesis (in eukaryotes) is
(a) GUA (b) GCA
(c) CCA (d) AUG

107. What is the best pH of soil for cultivation of plants ?
(a) 3.4 – 5.4 (b) 6.5 – 7.5
(c) 4.5 – 8.5 (d) 5.6 – 6.5

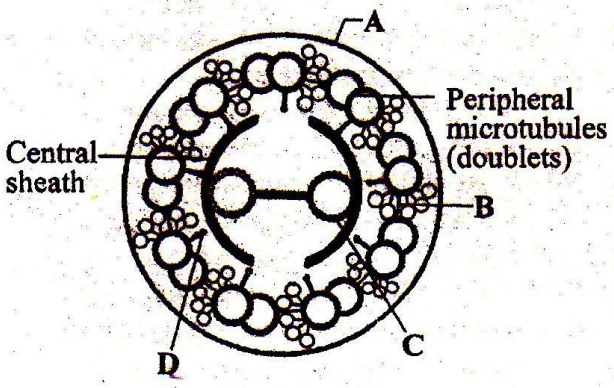
108. Telomerase is an enzyme which is a
(a) simple protein (b) RNA
(c) ribonucleoprotein (d) repetitive DNA

109. Mass of living matter at a trophic level in an area at any time is called
(a) standing crop (b) deteritus
(c) humus (d) standing state

110. The *Triticale* is an intergeneric hybrid between :
(a) wheat and maize (b) maize and rye
(c) wheat and rye (d) bajra and wheat

111. Which one is a neem product used as insect repellent?
(a) Azadirachtin (b) Rotenone
(c) Parathione (d) Endrin

112. Choose the correct option.



(a) A – Plasma membrane, B – Interdoublet bridge, C – Central microtubule, D – Radial spoke
(b) A – Plasma membrane, B – Arm, C – Central microtubule, D – Radial spoke
(c) A – Plasma membrane, B – Interdoublet bridge, C – Hub, D – Radial spoke
(d) A – Plasma membrane, B – Interdoublet bridge, C – Hub, D – Arm

113. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will be having
(a) low stability and high resilience
(b) high stability and low resilience
(c) low stability and low resilience
(d) high stability and high resilience

114. The mode of catching insects in *Drosera* plants is by means of
(a) sensitive glandular hairs which secrete a sweet, viscous, shining substance.
(b) specially sensitive trigger hairs.
(c) leaves which are modified into pitcher.
(d) leaf segments modified into bladder.

115. Quantasomes are present in
(a) chloroplast (b) mitochondria
(c) golgi body (d) lysosome

116. The water potential and osmotic potential of pure water are
(a) zero and zero (b) 100 and 100
(c) zero and 100 (d) 100 and zero

117. Photorespiration is favoured by
(a) high O_2 and low CO_2
(b) low light and high O_2
(c) low temperature and high O_2
(d) low O_2 and high CO_2

118. A free living nitrogen-fixing cyanobacterium which can also form symbiotic association with the water fern *Azolla* is
(a) *Tolypothrix* (b) *Chlorella*
(c) *Nostoc* (d) *Anabaena*

119. Hydroponics is
(a) nutrient less culture
(b) water less culture
(c) soilless culture
(d) None of these

120. Krebs cycle occurs in
(a) mitochondria (b) cytoplasm
(c) chloroplasts (d) ribosomes

121. Most abundant organic compound on earth is
(a) Protein (b) Cellulose
(c) Lipids (d) Steroids

122. Terminal cytochrome of respiratory chain which donates electrons to oxygen is
(a) Cyt. b (b) Cyt. c
(c) Cyt. a_1 (d) Cyt. a_3

123. To avoid excessive water loss during severe drought stress, the closure of stomata is signalled by the production of
(a) IAA (b) NAA
(c) ABA (d) IBA

124. In short day plants, flowering is induced by
(a) photoperiod less than 12 hours.
(b) photoperiod below a critical length and uninterrupted long night.
(c) long night.
(d) short photoperiod and interrupted long night.

125. The major reason that glycolysis is not as energy productive as respiration is that
(a) NAD^+ is regenerated by alcohol or lactate production, without the high-energy electrons passing through the electron transport chain.
(b) it is the pathway common to fermentation and respiration.
(c) it does not take place in a specialized membrane-bound organelle.
(d) pyruvate is more reduced than CO_2; it still contains much of the energy from glucose.

126. The catalytic efficiency of two different enzymes can be compared by the
(a) formation of the product
(b) pH optimum value
(c) K_m value
(d) molecular size of the enzyme

127. Biodiversity Act of India was passed by the parliament in the year
(a) 1992 (b) 1996
(c) 2000 (d) 2002

128. 'Axenic culture' is
(a) culture of tissue
(b) growing of shrubs
(c) growing of tall trees
(d) culture of tissue free from contamination

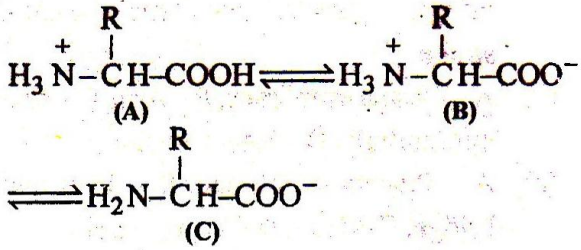
129. Which one thing is not true about antibiotics?
(a) The term "antibiotic" was coined by Selman Waksman in 1942
(b) First antibiotic was discovered by Alexander Flemming
(c) Each antibiotic is effective only against one particular kind of germ
(d) Some persons can be allergic to a particular antibiotic

130. Main objective of production/use of herbicide resistant GM crops is to
(a) eliminate weeds from the field without the use of manual labour
(b) eliminate weeds from the field without the use of herbicides
(c) encourage eco-friendly herbicides
(d) reduce herbicide accumulation in food articles for health safety

131. The common nitrogen fixer in paddy fields is
(a) *Rhizobium* (b) *Azospirillum*
(c) *Oscillatoria* (d) *Frankia*

132. In order to obtain virus- free plants through tissue culture, the best method is
(a) protoplast culture (b) embryo rescue
(c) anther culture (d) meristem culture

133. Which one of the following is a wrong matching?
(a) Somatic hybridization - Fusion of two diverse cells
(b) Vector DNA -Site for t-RNA synthesis
(c) Micropropagation - *in vitro* production of plants in large numbers
(d) Callus - Unorganised mass of cell produced in tissue culture

134. 
(A) (B) (C)

Which of the above is Zwitterionic form?
(a) A (b) C
(c) B (d) All of these

135. Restriction endonucleases are enzymes which
(a) make cuts at specific positions within the DNA molecule
(b) recognize a specific nucleotide sequence for binding of DNA ligase
(c) restrict the action of the enzyme DNA polymerase
(d) remove nucleotides from the ends of the DNA molecule

SECTION 4 - ZOOLOGY

136. Sex factor in bacteria is
(a) Chromosomal replicon
(b) F-replicon
(c) RNA
(d) Sex-pilus

137. Animals/organisms floating on the surface of water are
(a) plankton (b) pelagic
(c) benthos (d) neritic

138. The cell junctions called tight, adhering and gap junctions are found in
(a) connective tissue (b) epithelial tissue
(c) neural tissue (d) muscular tissue

139. Spleen is referred to as
(a) temporary endocrine gland
(b) graveyard of RBC
(c) largest gland
(d) store house of WBC

140. Given below are four matchings of an animal and its kind of respiratory organ :
(i) Silver fish – trachea
(ii) Scorpion – book lung
(iii) Sea squirt – pharyngeal gills
(iv) Dolphin – skin
The correct matchings are
(a) (iii) and (iv) (b) (i) and (iv)
(c) (i), (ii) and (iii) (d) (ii) and (iv)

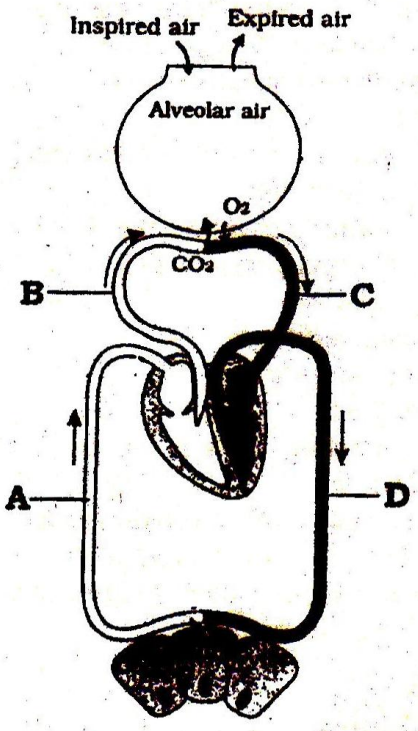
141. In the mouthparts of the cockroach, the organ of mastication is
(a) labium (b) maxillae
(c) mandibles (d) labrum

142. Which one of the following characters is not typical of the class Mammalia?
(a) Thecodont dentition
(b) Alveolar lungs
(c) Ten pairs of cranial nerves
(d) Seven cervical vertebrae

143. Natural parthenogenesis occurs in:
(a) Protozoans (b) Earthworm
(c) All insects (d) Honeybee

144. Consider the statements given below regarding contraception and answer as directed thereafter:
(i) Medical Termination of Pregnancy (MTP) during first trimester is generally safe
(ii) Generally chances of conception are nil until mother breast-feeds the infant upto two years
(iii) Intrauterine devices like copper-T are effective contraceptives
(iv) Contraception pills may be taken upto one week after coitus to prevent conception
Which two of the above statements are correct?
(a) ii and iii (b) iii and iv
(c) i and iii (d) i and ii

145. Identify the blood vessels A to D.



(a) A- Systemic vein, B-Pulmonary artery, C-Pulmonary vein, D-Systemic artery
(b) A-Systemic artery, B-Pulmonary artery, C- Pulmonary vein, D- Systemic vein
(c) A-Pulmonary artery, B-Systemic vein, C-Pulmonary vein, D- Systemic artery
(d) A-Systemic vein, B-Pulmonary vein, C- Pulmonary artery, D- Systemic artery

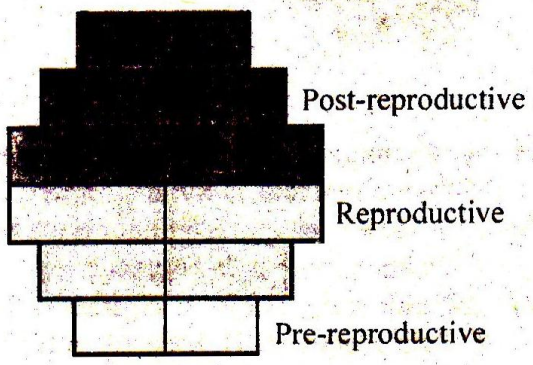
146. Which pathway of the male reproductive system is correct for the sperms transportation?
(a) Vas efferentia→Vas deferens→Epididymis
(b) Vas deferens→Epididymis→Seminal vesicle
(c) Epididymis→Vas deferens→Urethra
(d) Rete testis→Epididymis→Vas efferentia

147. The second maturation division of the mammalian ovum occurs:
(a) in the Graafian follicle following the first maturation division
(b) Shortly after ovulation before the ovum makes entry into the fallopian tube
(c) Until after the ovum has been penetrated by a sperm
(d) Until the nucleus of the sperm has fused with that of the ovum

148. A force acting against achievement of highest possible level of population growth is
(a) Carrying capacity
(b) Environment resistance
(c) Population pressure
(d) Saturation level

149. The phase of menstrual cycle in humans that lasts for 7-8 days, is
(a) follicular phase (b) ovulatory phase
(c) luteal phase (d) menstruation

150. What type of human population is represented by the following age pyramid?



(a) Vanishing population
(b) Stable population
(c) Declining population
(d) Expanding population

151. The 'Mule' is the result of
(a) Inbreeding depression
(b) Out breeding
(c) Cross breeding
(d) Inter-specific hybridization

152. Haemophilia is more common in males because it is a
(a) Recessive character carried by Y–chromosome
(b) Dominant character carried by Y-chromosome
(c) Dominant trait carried by X-chromosome
(d) Recessive trait carried by X-chromosome

153. Theory of inheritance of acquired characters was given by
(a) Wallace (b) Lamarck
(c) Darwin (d) De Vries

154. The animal husbandry deals with the care, breeding and management of
(a) Domesticated animals
(b) Fishes
(c) Honey bees and silk worms
(d) All of these

155. 'Inland fishery' refers to
(a) Culturing fish in fresh water
(b) Trapping and capturing fishes from sea coast
(c) Deep sea fishing
(d) Extraction of oil from fishes

156. The most popular breed of fowl in India is
(a) White leg horn (b) Aseel
(c) Plymouth (d) Langshan

157. Which of following teeth are lophodont?
(a) Incisor and canine
(b) Premolar and molar
(c) Canine and premolar
(d) Premolar and incisor

158. Pacemaker of heart is
(a) AV node (b) Bundle of His
(c) SA node (d) Purkinje fibres

159. Uricotelism is found in
(a) Frogs and toads
(b) Mammals and birds
(c) Birds, reptiles and insects
(d) Fishes and fresh water protozoans

160. A large proportion of oxygen is left unused in the human blood even after its uptake by the body tissues. This O_2
(a) acts as a reserve during muscular exercise
(b) raise the pCO_2 of blood to 75 mm of Hg.
(c) is enough to keep oxyhaemoglobin saturation at 96%
(d) helps in releasing more O_2 to the epithelial tissues.

161. The basic functional unit of the human kidney is
(a) nephron (b) nephridia
(c) pyramid (d) Henle's loop

162. Urea from the blood can be removed by
(a) Uremia (b) Diuresis
(c) Dialysis (d) Micturition

163. Which one of the following correctly explains the function of a specific part of a human nephron ?
(a) Podocytes : create minute spaces (slite pores) for the filtration of blood into the Bowman's capsule.
(b) Henle's loop : most reabsorption of the major substances from the glomerular filtrate.
(c) Distal convoluted tubule : reabsorption of K^+ ions into the surrounding blood capillaries.
(d) Afferent arteriole : carries the blood away from the glomerular towards renal vein.

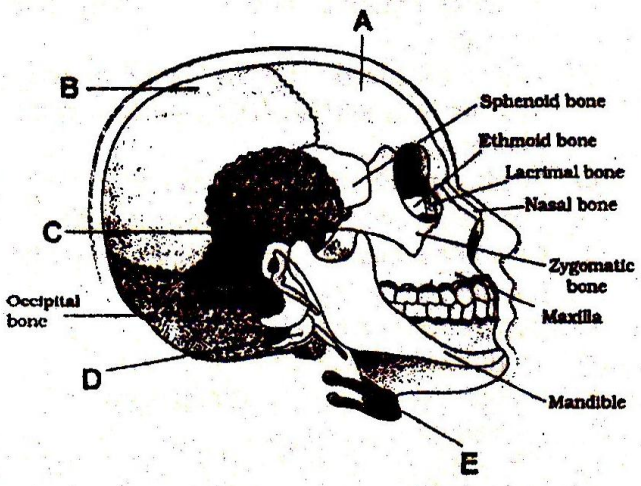
164. The nerve centres which control the body temperature and the urge for eating are contained in:
(a) hypothalamus (b) pons
(c) cerebellum (d) thalamus

165. Rods and cones of eyes are modified
(a) multipolar neuron
(b) unipolar neuron
(c) bipolar neuron
(d) None of these

166. Which of the following is both exocrine and endocrine gland ?
(a) Liver (b) Pancreas
(c) Thyroid (d) Adrenal

167. The sensation of fatigue in the muscles after prolonged strenuous physical work, is caused by
(a) a decrease in the supply of oxygen
(b) minor wear and tear of muscle fibres
(c) the depletion of glucose
(d) the accumulation of lactic acid

168. Consider the diagram given below



Identify the labelled parts as A, B, C, D and E respectively.
(a) Frontal bone, Parietal bone, Temporal bone, Occipital condyle and Hyoid bone
(b) Frontal bone, Temporal bone, Parietal bone, Occipital condyle and Hyoid bone
(c) Frontal bone, Parietal bone, Temporal bone, Hyoid bone and Occipital condyle
(d) Parietal bone, Frontal bone, Temporal bone, Occipital condyle and Hyoid bone

169. Which one of the following statements is incorrect ?
(a) The presence of non-respiratory air sacs, increases the efficiency of respiration in birds.
(b) In insects, circulating body fluids serve to distribute oxygen to tissues.
(c) The principle of countercurrent flow facilitates efficient respiration in gills of fishes.
(d) The residual air in lungs slightly decreases the efficiency of respriration in mammals.

170. Which one of the following does not act as a neurotransmitter ?
(a) Epinephrine (b) Norepinephrine
(c) Cortisone (d) Acetylcholine

171. Which one of the following statements is correct?
(a) Neurons regulate endocrine activity, but not *vice versa.*
(b) Endocrine glands regulate neural activity and nervous system regulates endocrine glands.
(c) Neither hormones control neural activity nor the neurons control endocrine activity.
(d) Endocrine glands regulate neural activity but not *vice versa.*

172. 'Cloning' is meant for/to
(a) production of hGH gene in *E. coli*
(b) preserve the genotype of organism
(c) replace the original gene
(d) All of the above

173. A cell coded protein formed in response to infection with most animal viruses is
(a) Antigen (b) Antibody
(c) Interferon (d) Histone

174. Which one of the following is not used in organic farming?
(a) *Glomus* (b) Earthworm
(c) *Oscillatoria* (d) Snail

175. ELISA is used to detect viruses where the key reagent is
(a) RNase
(b) alkaline phosphatase
(c) catalase
(d) DNA probe

176. Vitamin B_{12} is formed during fermentation of
(a) *Ashloya gossipii*
(b) *Rhizopus stolonifer*
(c) *Propionibacteria*
(d) *Saccharomyces cerevisiae*

177. Which one is a correctly match sexually transmitted disease with its pathogen?
(a) Syphilis – *Leishmania donovani*
(b) AIDS – *Bacillus anthracis*
(c) Urethritis – *Entamoeba gingivalis*
(d) Gonorrhoea – *Neisseria gonorrhoeae*

178. Which one of the following depresses brain activity and produced feelings of calmness, relaxation and drowsiness?
(a) Morphine (b) Valium
(c) Amphetamines (d) Hashish

179. Which one of the following is correctly matched pair of the given secretion and its primary role in human physiology?
(a) Sebum — Sexual attraction
(b) Sweat — Thermoregulation
(c) Saliva — Tasting food
(d) Tears — Excretion of salts

180. Consider the following four statements (i-iv) and select the option which includes all the correct ones only.
(i) Single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins etc.
(ii) Body weight-wise the micro-organism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day.
(iii) Common button mushrooms are a very rich source of vitamin C.
(iv) A rice variety has been developed which is very rich in calcium.
(a) Statements (ii) and (iv)
(b) Statements (i), (iii) and (iv)
(c) Statements (ii), (iii) and (iv)
(d) Statements (i) and (ii)