Dated : 08-04-2023

M.L. Syal's Helix Institute

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Test Series HMC-8 [Option -2]

Test - 04

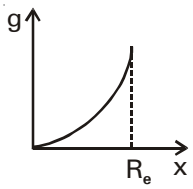
MM : 720 Time : 3 hrs. 20 min.

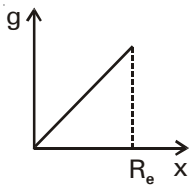
PHYSICS : SHM, WAVES, GRAVITATION
CHEMISTRY : THERMODYNAMICS, HYDROGEN, CHEMISTRY IN ACTION, GASEOUS STATE, EXTRACTION
ZOOLOGY : BODY FLUIDS & CIRCULATION, ANIMAL KINGDOM, EPITHELIAL TISSUES & CT PROPER
BOTANY : PLANT KINGDOM, STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

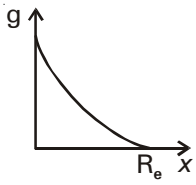
PHYSICS : SECTION-A

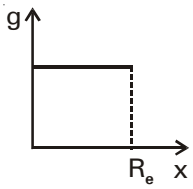
All questions are compulsory in section A

1. If velocity of sound in a gas is 360 m/s and the distance between a compression and the nearest rarefaction is 1m, then the frequency of sound is
   (1) 90 Hz (2) 180 Hz
   (3) 360 Hz (4) 720 Hz
2. The gravitational force between two objects does not depend on
   (1) medium between two bodies
   (2) product of the masses
   (3) gravitational constant
   (4) distance between the masses
3. A 2 kg body is situated in the potential field $V = (8x^2 + 20)$ J/kg. The frequency of oscillations will be
   (1) 1.21 cycle/s (2) 0.64 cycle/s
   (3) 0.82 cycle/s (4) 1.04 cycle/s
4. In case of a forced vibration, the resonance wave becomes very sharp when the
   (1) restoring force is small
   (2) applied periodic force is small
   (3) damping force is small
   (4) none of these
5. As we move from centre of earth towards the surface, the variation in acceleration due to gravity (g) with distance (x) is represented by the graph

(1) 

(2) 

(3) 

(4) 

6. Which one of the following does not represent a travelling wave?
   (1) $y = \sin(x - vt)$ (2) $y = y_m \sin k(x + vt)$
   (3) $y = y_m e^{-(x - vt)2}$ (4) $y = y_m \sin(x^2 - vt^2)$
7. The ratio of the speed of sound in nitrogen gas to that in helium gas, at 300 K is
   (1) $\sqrt{\frac{2}{7}}$ (2) $\sqrt{\frac{1}{7}}$
   (3) $\sqrt{\frac{3}{50}}$ (4) $\sqrt{\frac{3}{25}}$

8. Three particles each of mass 'm' are placed at the corners of an equilateral triangle of side 'b'. What will be the gravitational PE of the system of the particles?

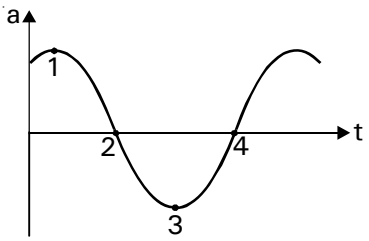
(1) $-\frac{3Gm^2}{2b}$ (2) $-\frac{Gm^2}{2b}$

(3) $-\frac{3Gm^2}{b}$ (4) $-\frac{Gm^2}{b}$

9. Speed of a satellite orbiting very close to earth, may be increased by how much percent, so as to enable it to escape from the gravitational pull?

(1) 100% (2) 41%

(3) 7% (4) 71%

10. 

The acceleration of a particle undergoing S.H.M. is shown in the figure. Which of the labelled points corresponds to particle being at $-x_{max}$?

(1) 4 (2) 3

(3) 2 (4) 1

11. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet, if it is a second's pendulum on earth, will be

(1) $\frac{1}{\sqrt{2}}$ s (2) $2\sqrt{2}$ s

(3) 2 s (4) $\frac{1}{2}$ s

12. **Assertion** : In resonance tube experiment, as the level of water is lowered, wave length of sound at resonance increases.

Reason : In resonance tube experiment, as the level of water is lowered, the number of loops at resonance increases.

(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion

(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion

(3) Assertion is true statement but Reason is false

(4) Assertion is false

13. If density of earth is increased four times and its radius becomes half of what it is, our weight will

(1) be four times its present value

(2) be doubled

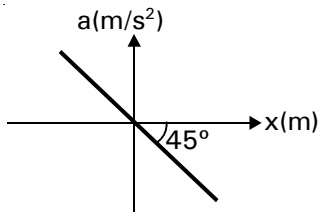
(3) remain same

(4) be halved

14. In a transverse progressive wave of amplitude A, the maximum particle velocity is twice the wave velocity. The wavelength of the wave is

(1) $\frac{\pi A}{4}$ (2) $\frac{\pi A}{2}$

(3) πA (4) $2\pi A$

15. 

Acceleration-displacement graph of a particle executing SHM is shown above. Time period of its oscillation in seconds is

(1) $\frac{\pi}{2}$ (2) 2π

(3) π (4) $\frac{\pi}{4}$

16. A source of sound of frequency 840 Hz is moving towards a stationary observer with 20 m/s speed. If the speed of sound is 320 m/s, then the wavelength perceived by observer is

(1) 0.38 m (2) 0.36 m

(3) 0.41 m (4) 0.37 m

17. Difference in loudness levels of two sounds of intensities 50 watts/m^2 and 100 watts/m^2 is about

(1) 2 dB (2) 0.2 dB

(3) 0.3 dB (4) 3 dB

18. The maximum velocity of a particle executing S.H.M. is 8 cm/s and its acceleration at a distance of 4 cm from mean position is 16 cm/s^2. Its amplitude will be

(1) 2 cm (2) 3 cm

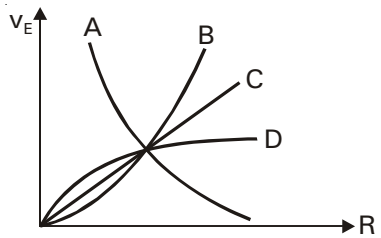
(3) 4 cm (4) 8 cm

19. The minimum speed with which the body must be thrown from the surface of the earth so as to reach a height of R/5 is

(1) $\sqrt{gR/3}$ (2) $\sqrt{2gR/3}$

(3) $\sqrt{gR/6}$ (4) $\sqrt{2gR/5}$

20. Which graph best represents the variation of escape speed v_E from the surface of different planets of same mass versus their radius R?



(1) A (2) B

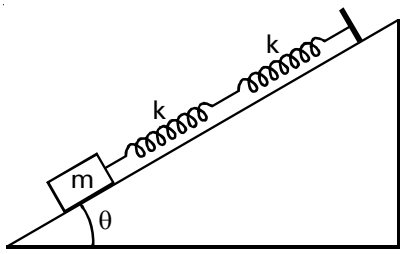
(3) C (4) D

21. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is

(1) 1 : 2 (2) 4 : 1

(3) 8 : 3 (4) 3 : 8

22.



Time period of the system shown above is

(1) $2\pi\sqrt{\frac{m}{k}}$ (2) $2\pi\sqrt{\frac{2m\sin\theta}{k}}$

(3) $2\pi\sqrt{\frac{2m}{k}}$ (4) $2\pi\sqrt{\frac{m}{k\sin\theta}}$

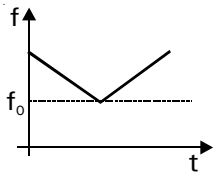
23. Quality of a musical note depends on
(1) harmonics present
(2) amplitude of the wave
(3) fundamental frequency
(4) velocity of sound in the medium

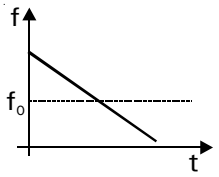
24. A string, fixed at both ends, vibrates in a resonant mode with a separation of 2cm between two nearest nodes. For the next higher resonant frequency of same string with same tension, this separation is reduced to 1.6cm. Then, the length of the string is
(1) 4 cm (2) 8 cm
(3) 16 cm (4) 20 cm

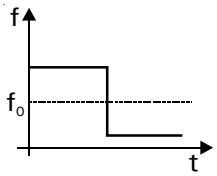
25. A satellite moves around the earth in a circular orbit of radius 'r' with speed 'v'. If the mass of the satellite is M, its total energy is
(1) $-\frac{1}{2}Mv^2$ (2) $\frac{1}{2}Mv^2$
(3) $2Mv^2$ (4) Mv^2

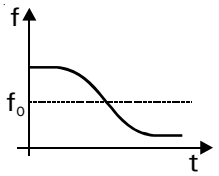
26. The scale of a spring balance reading from 0 to 10 kg is 0.25 m long. A body suspended from the balance oscillates vertically with a period of $\pi/10$ second. The mass suspended is (neglect the mass of the spring)
(1) 10 kg (2) 1 kg
(3) 5 kg (4) 20 kg

27. An observer stands at distance of 100 m away from the bed of rail road. As the train passes him producing sound of frequency f_0, qualitatively, the variation of train whistle frequency for the observer with time t is best represented by

(1) 

(2) 

(3) 

(4) 

28. If the gravitational force varies inversely as the nth power of the distance, the time period of a satellite revolving in a circular orbit round the earth at distance 'r' from centre of earth is proportional to
(1) $(r)^{\frac{n+1}{2}}$ (2) $(r)^{\frac{n-1}{2}}$
(3) $\frac{1}{\sqrt{r^{n-1}}}$ (4) $\frac{1}{\sqrt{r^{n+1}}}$

29. A body executing simple harmonic motion has a potential energy 350 J at extreme position and 30J at mean position. At the instant, the displacement is one-fourth of amplitude, kinetic energy is

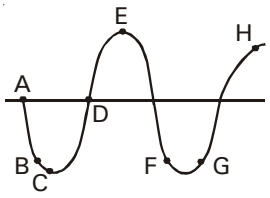
(1) 320 J (2) 270 J
(3) 240 J (4) 300 J

30. The effective value of gravity at the latitude 30°, given that radius of the earth is R, its angular velocity is ω and the value of gravity at the poles is 'g', is

(1) $g - \frac{1}{4} R\omega^2$ (2) $g + \frac{3}{4} R\omega^2$

(3) $g - \frac{3}{4} R\omega^2$ (4) $g + \frac{1}{4} R\omega^2$

31. The diagram given below shows the profile of a wave. Which points are in phase?



(1) F and G (2) C and E
(3) B and G (4) B and F

32. What is the weight of a body at a distance 2r from the centre of the earth if the gravitational potential energy of the body at a distance r from the centre of the earth is U?

(1) $\frac{U}{2r}$ (2) $\frac{U}{3r}$

(3) $\frac{U}{4r}$ (4) $\frac{U}{r}$

33. A brass cube of side 'a' and density σ is floating in mercury of density ρ. If the cube is displaced vertically by small distance, it executes S.H.M. Its time period will be

(1) $2\pi\sqrt{\frac{\sigma a}{\rho g}}$ (2) $2\pi\sqrt{\frac{\rho a}{\sigma g}}$

(3) $2\pi\sqrt{\frac{\rho g}{\sigma a}}$ (4) $2\pi\sqrt{\frac{\sigma g}{\rho a}}$

34. A simple pendulum P is oscillating in a room. Another identical pendulum Q is oscillating with same amplitude inside a lift accelerating up. Then for pendulum Q, as compared to P,

(1) frequency of oscillations is more
(2) energy of oscillation is more
(3) both (1) and (2)
(4) neither (1) nor (2)

35. Two tuning forks when sounded together produced 4 beats/sec. The frequency of one fork is 256 Hz. The number of beats heard increases when the fork of frequency 256 Hz is loaded with wax. The frequency of the other fork is

(1) 504 Hz (2) 520 Hz
(3) 260 Hz (4) 252 Hz

PHYSICS : SECTION-B

This section has 15 questions, attempt any 10 questions of them.

36. Kinetic energy in a stationary wave when all the particles are at mean position

(1) is same for all particles
(2) is zero for all particles
(3) is minimum at nodes and maximum at antinodes
(4) is maximum at nodes and minimum at antinodes

37. Earth revolves about the sun in an elliptical orbit with mean radius 9.3×10^7 m and with a time period of 1 year. Assuming that there are no outside influences, the earth's
(1) kinetic energy remains constant
(2) angular momentum remains constant
(3) total energy remains constant
(4) both (2) & (3)

38. It is desired to increase the fundamental resonance frequency in a tube which is closed at one end. This can be achieved by
a. replacing the air in the tube by hydrogen gas
b. increasing the length of the tube
c. decreasing the length of the tube
d. opening the closed end of the tube
(1) both a & d (2) both b & c
(3) a, b & c (4) a, c & d

39. Which of the following pairs of sound frequencies can produce observable beats?
(1) 100 Hz and 140 Hz
(2) 20 Hz and 35 Hz
(3) 10 Hz and 12 Hz
(4) 100 Hz and 104 Hz

40. The amplitude and the time period in a S.H.M. is 0.5 cm and 0.4 s respectively. If the initial phase is $\pi/2$ radian, then equation of S.H.M. will be
(1) $y = 0.5 \sin 5\pi t$ (2) $y = 0.5 \sin 4\pi t$
(3) $y = 0.5 \sin 2.5\pi t$ (4) $y = 0.5 \cos 5\pi t$

41. Let the gravitational force the earth exerts on the moon be F. Then the gravitational force the moon exerts on earth is
(1) F (2) larger than F
(3) smaller than F (4) zero

42. The length of a simple pendulum executing simple harmonic motion is increased by 21%. The percentage increase in the time period of the pendulum of increased length is
(1) 10% (2) 11%
(3) 21% (4) 42%

43. One end of a spring of force constant 'k' is fixed to a vertical wall and other to a block of mass 'm' resting on a smooth horizontal surface. There is a second wall on the opposite side at a distance x_0 from the block. Spring is now compressed by $2x_0$ and the block is released. Minimum time taken by the block to strike the second wall is
(1) $\pi\sqrt{\frac{m}{k}}$ (2) $\frac{4\pi}{3}\sqrt{\frac{m}{k}}$
(3) $\frac{2\pi}{3}\sqrt{\frac{m}{k}}$ (4) $\frac{\pi}{4}\sqrt{\frac{m}{k}}$

44. Standing waves are produced in a 8 m long stretched string. If the string vibrates in 20 segments and the wave velocity is 100 m/s, the frequency is
(1) 160 Hz (2) 125 Hz
(3) 100 Hz (4) 80 Hz

45. A tunnel is dug along the diameter of the earth. There is a particle at the centre of the tunnel. The minimum velocity given to the particle so that it just reaches the surface of the earth is about
(1) 11.2 km/s (2) 5.6 km/s
(3) 8 km/s (4) 16 km/s

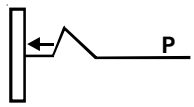
46. Function $\sin^2(\omega t)$ represents
(1) an SHM with a period $2\pi/\omega$
(2) an SHM with a period π/ω
(3) a periodic motion with a period $2\pi/\omega$ but not an SHM
(4) a periodic motion with a period π/ω but not an SHM

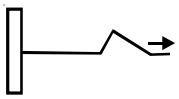
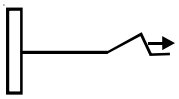
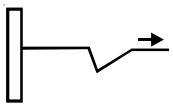
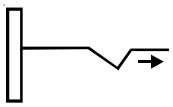
47. A motor car blowing a horn of frequency 200 Hz moves with a velocity 90 km/hr towards a tall wall. Frequency of reflected sound heard by the driver will be (velocity of sound in air is 320 m/s)
(1) 171 vib/s (2) 234 vib/s
(3) 200 vib/s (4) 217 vib/s

48. **Assertion** : Earth moves faster when close to Sun and slower when far from it.
Reason : Angular momentum of the earth has to remain constant.
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion
(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
(3) Assertion is true statement but Reason is false
(4) Assertion is false

49. Two identical solid metal spheres of density 'd' and radius R each are touching each other. What is the gravitational force of attraction between them?
(1) $\frac{4}{9}G\pi^2d^2R^4$ (2) $\frac{9}{4}G\pi^2d^2R^4$
(3) $\frac{4}{9}G\pi d^2R^2$ (4) $\frac{9}{4}G\pi d^2R^2$

50. Figure here shows an incident pulse P reflected from a rigid support. Which one of the figures represents the reflected pulse correctly



(1) 
(2) 
(3) 
(4) 

CHEMISTRY : SECTION-A

All questions are compulsory in section A

51. Heat liberated when 100 ml of 1N NaOH is neutralised by 300 ml of 1N HCl
(1) 11.46 kJ (2) 5.73 kJ
(3) 22.92 kJ (4) 17.19 kJ

52. The heat of combustion of yellow P and red P are -9.91 kJ mol^{-1} and -8.78 kJ mol^{-1} respectively. The heat of transition of yellow P $\rightarrow$ red P is
(1) -18.69 kJ (2) $+1.13$ kJ
(3) $+18.69$ kJ (4) -1.13 kJ

53. At a constant pressure, what should be the %age increase in the temperature in Kelvin for a 10% increase in volume
(1) 10 (2) 20
(3) 5 (4) 50

54. Which of the following reaction represents calcination process?

(1) $CaCO_3 \longrightarrow CaO + CO_2$

(2) $Cu_2S + 2CuO \longrightarrow 4Cu + SO_2$

(3) $4FeS_2 + 11O_2 \longrightarrow 2Fe_2O_3 + 8SO_2$

(4) $FeO + SiO_2 \longrightarrow FeSiO_3$

55. Which of the following ores are concentrated by froth floation?

(i) Haematite (ii) Galena

(iii) Copper pyrites (iv) Magnetite

(1) Both (ii) & (iv) (2) Both (i) & (ii)

(3) Both (iii) & (iv) (4) Both (ii) and (iii)

56. H_2O_2 decomposes slowly on exposure to light

$$2H_2O_2(l) \xrightarrow{\text{catalyst}} 2H_2O(l) + O_2(g)$$

The catalyst is

(1) Metal surfaces or traces of alkali

(2) Urea

(3) Orthophosphoric acid

(4) Sodium stannate

57. Which of the following is an example of extensive property?

(1) Molar heat capacity

(2) Density

(3) Refractive index

(4) Enthalpy

58. Equanil is

(1) artificial sweetener (2) tranquilizer

(3) antihistamine (4) antifertility drug

59. **Statement-I** :The process $X(g) + 2Y(g) \rightarrow Z(g)$ $\Delta H = 171$ kJ is non spontaneous at all temperature.
Statement-II : ΔS_{system} for a spontaneous process is always positive.

(1) Both statement-I and statement-II are correct

(2) Both statement-I and statement-II are incorrect

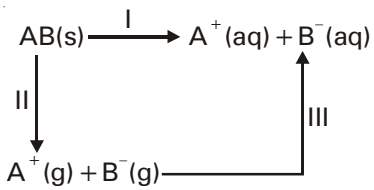
(3) Statement-I is correct but statement-II is incorrect

(4) Statement-I is incorrect but statement-II is correct

60. H_2O_2 prepared from _____ by autoxidation

(1) 2-Ethyl anthraquinol (2) BaO_2

(3) Na_2O_2 (4) All of these

61. 

I , II and III respectively are

(1) $\Delta H^0_{Lattice}$, ΔH^0_{Hyd} , ΔH^0_{sol}

(2) $\Delta H^0_{Lattice}$, ΔH^0_{sol} , ΔH^0_{Hyd}

(3) ΔH^0_{sol} , $\Delta H^0_{Lattice}$, ΔH^0_{Hyd}

(4) ΔH^0_{sol} , ΔH^0_{Hyd} , $\Delta H^0_{Lattice}$

62. The mass of H_2O_2 present in 1 L of a 2M H_2O_2 solution is

(1) 34 g (2) 68 g

(3) 17 g (4) 51 g

63. Which mixture of gases at room temperature does not follow Dalton's law of partial pressures?
(1) NO_2 and O_2 (2) NH_3 and HCl
(3) CO and CO_2 (4) SO_2 and O_2

64. Select correct order of molecular velocities
(1) $u_{rms} < u_{av} < u_{mp}$ (2) $u_{av} < u_{mp} < u_{rms}$
(3) $u_{mp} < u_{av} < u_{rms}$ (4) $u_{mp} < u_{rms} < u_{av}$

65. In a closed flask of 5 litre, 1.0 g of H_2 is heated form 300-600 K. Which statement is not correct?
(1) The rate of collision increases
(2) The energy of gaseous molecules increases
(3) The number of mole of the gas increases
(4) Pressure of the gas increases

66. Match the following

Column -I (Process)		**Column -II (ΔG)**
a. Melting of ice at 270.9K	i.	Negative
b. Melting of ice at 273K	ii.	zero
c. Melting of ice at 276.3K	iii.	positive

(1) a–i, b–ii, c–iii
(2) a–i, b–iii, c–ii
(3) a–iii, b–i, c–ii
(4) a–iii, b–ii, c–i

67. **Assertion** : D_2O and H_2O have same chemical properties.
Reason : D_2O and H_2O are different allotropes of water.
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion
(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
(3) Assertion is true statement but Reason is false
(4) Assertion is false

68. Less branching of hydrocarbon chain of synthetic detergents
(1) make their biodegradability difficult
(2) make no effect on biodegradability
(3) make their biodegradability easy
(4) make effect on biodegradability depending upon the nature of detergents

69. From the folloiwng data
(i) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g); \Delta H = -242$ KJ/mol
(ii) $\Delta H_{Diss.}$ of $H_2(g) = +436$KJ/mol
(iii) $\Delta H_{Diss.}$ of $O_2(g) = +500$KJ/mol
The bond dissociation enthalpy of O–H bond is (in KJ/mol)
(1) +121 (2) +928
(3) +444 (4) +464

70. In blister copper, the blisters are formed due to passing out of the following gas
(1) Nitrogen (2) CO
(3) CO_2 (4) SO_2

71. Which has ion induced-dipole interaction?
(1) Cl_2 and water (2) H_2O and He
(3) NO_3^- and I_2 (4) HBr and HBr

72. Calgon is
(1) Sodium aluminium silicate
(2) Calcium silicate
(3) hexameta phosphate
(4) Poly sulphates

73. Which of the following reactions increases production of dihydrogen from synthesis gas?
(1) $CH_4(g) + H_2O(g) \xrightarrow[Ni]{1270\,K} CO(g) + 3H_2(g)$
(2) $C(s) + H_2O(g) \xrightarrow{1270\,K} CO(g) + H_2(g)$
(3) $CO(g) + H_2O(g) \xrightarrow[Catalyst]{673\,K} CO_2(g) + H_2(g)$
(4) $C_2H_6 + 2H_2O \xrightarrow[Ni]{1270\,K} 2CO + 5H_2$

74. Equal weights of methane and hydrogen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by hydrogen is
(1) $\frac{1}{2}$ (2) $\frac{8}{9}$
(3) $\frac{1}{9}$ (4) $\frac{16}{19}$

75. 32 g of orthorhombic sulphur when burnt in excess of oxygen at 1 atmosphere liberated 'Q' kJ of heat. Enthalpy of combustion of orthorhombic sulphur is_____ kJ/mol

(1) $-8Q$ (2) $-Q$

(3) $-4Q$ (4) $\frac{-Q}{8}$

76. Which of the following reaction defines ΔH_f^0 ?

(1) $C_{(diamond)} + O_2(g) \rightarrow CO_2(g)$

(2) $\frac{1}{2}H_2(g) + \frac{1}{2}F_2(g) \rightarrow HF(\ell)$

(3) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

(4) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

77. High purity (99.95%) dihydrogen is prepared by

(1) electrolysing warm $Ba(OH)_2(aq)$

(2) electrolysing water

(3) electrolysing Brine solution

(4) all of these

78. If 2g each of the given gases are taken at S.T.P, the gas that will have highest volume is

(1) N_2O (2) O_2

(3) CO (4) CH_4

79. Pick correct statement

(1) Noble gas can't be liquified

(2) Ideal gas can be liquified by applying pressure

(3) Real gas can be liquified without applying pressure

(4) Real gases can be liquified by applying P

80. Which of the following statements, about the advantage of roasting of sulphide ore before reduction is not true?

(1) roasting of the sulphide to the oxide is thermodynamically feasible.

(2) carbon and hydrogen are suitable reducing agents for metal sulphides.

(3) The $\Delta_f G^0$ of the sulphide is greater than those for CS_2 and H_2S.

(4) The $\Delta_f G^0$ is negative for roasting of sulphide ore to oxide.

81. The deviation of a real gas from ideal gas behaviour is expected to be minimum at

(1) 450 K and 4 atm

(2) 250 K and 3 atm

(3) 550 K and 0.5 atm

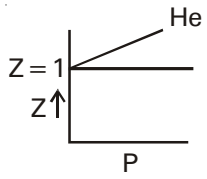
(4) 350 K and 2 atm

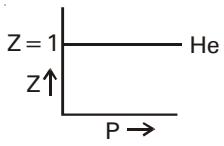
82. The equilibrium constant for certain reaction is 100 at 500 K. If value of R is 2 cal K^{-1} mol^{-1} then standard Gibb's free energy change will be

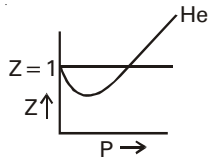
(1) -5.8 kcal (2) -4.606 kcal

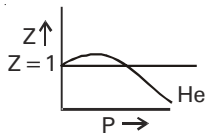
(3) -8.40 kcal (4) -12.6 kcal

83. Which of the following represents a plot of compressibility factor (Z) Vs P at room temperature for helium?

(1) 

(2) 

(3) 

(4) 

84. The volume of oxygen liberated at NTP from 15 ml of 20V H_2O_2.

(1) 350 ml (2) 300 ml

(3) 20 ml (4) 200 ml

85. The compressibility factor (Z) of a gas is less than unity at S.T.P. Therefore molar volume (V_m) of gas is

(1) >22.4 litres (2) <22.4 litres

(3) 22.4 litres (4) 44.8 litres

CHEMISTRY : SECTION-B

This section has 15 questions, attempt any 10 questions of them.

86. The molar enthalpies of combustion of isobutane and n-butane are -2870 kJ mol^{-1} and -2878 kJ mol^{-1} respectively at 298 K and 1 atm. Calculate ΔH^{o} for the conversion of 1 mol of n-butane to 1 mol of isobutane

(1) -8 kJ mol^{-1} (2) $+8$ kJ mol^{-1}

(3) -5748 kJ mol^{-1} (4) $+5748$ kJ mol^{-1}

87. Match the column-I and column-I

Column-I	**Column-II**
a. If force of attraction among the gas molecules be negligible	p. $\left(P+\frac{a}{V^2}\right)(V-b)=RT$
b. If the volume of the gas molecules be negligible	q. $PV=RT-\frac{a}{V}$
c. both a and b are significant	r. $PV=RT+Pb$
d. At low pressure and at high temperature	s. $PV=RT$

(1) a-r, b-s, c-q, d-p (2) a-q, b-r, c-p, d-s

(3) a-r, b-q, c-p, d-s (4) a-s, b-r, c-p, d-q

88. Consider the reaction : $N_2+3H_2 \rightarrow 2NH_3$ carried out at constant temperature and pressure. If ΔH and ΔU are the enthalpy and internal energy changes for the reaction, which of the following expression is true?

(1) $\Delta H = 0$ (2) $\Delta H = \Delta U$

(3) $\Delta H < \Delta U$ (4) $\Delta H > \Delta U$

89. **Statement-I** : Zirconium can be purified by Van Arkel method.
Statement-II : ZrI_4 is volatile and decomposes at 1800K.

(1) Both statement-I and statement-II are correct

(2) Both statement-I and statement-II are incorrect

(3) Statement-I is correct but statement-II is incorrect

(4) Statement-I is incorrect but statement-II is correct

90. Which of the following elements does not form hydride?

(1) Cr (2) Mn

(3) Na (4) Zn

91. Electromagnetic separation is used in the concentration of

(1) copper pyrites (2) bauxite

(3) cassiterite (4) cinnabar

92. Which one is a correct expression ?

(1) $\Delta S_{total}=\frac{q_{sys}}{T}$

(2) $\Delta S_{total} \neq 0$ (for irreversible process)

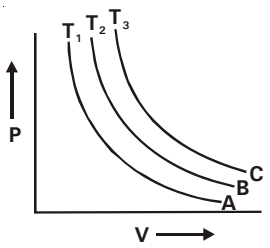
(3) $\Delta S_{total} \neq 0$ (for reversible process)

(4) $\Delta S=\frac{\Delta H}{T}$ (for any value of P)

93. An ideal gas expands isothermally and reversibly from state 'A' (5 Litres, 20 atm) to state 'B' (50 litres and 2 atm). Work done during the process is

(1) -2.326 kJ (2) -2.326 J

(3) -23.26 kJ (4) -23.26 J

94. 

Three isothermal plots (P versus V) A,B and C are plotted at three temperatures T_1, T_2 and T_3 respectively.
The correct order of temperature will be
(1) $T_1 < T_2 < T_3$ (2) $T_1 = T_2 = T_3$
(3) $T_1 > T_2 > T_3$ (4) $T_1 > T_2 < T_3$

95. **Assertion** : The enthalpy of formation of gaseous oxygen molecules at 298 K and under a pressure of one atm is zero.
Reason : The entropy of formation of gaseous oxygen molecules under the same condition is zero.
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion
(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
(3) Assertion is true statement but Reason is false
(4) Assertion is false

96. Which of the following is a synthetic detergent?
(1) Sodium palmitate
(2) Sodium p-dodecylbenzenesulphonate
(3) Morphine
(4) Sodium stearate

97. Identify the mismatch
(1) Chloramphenicol – antibiotic
(2) Diphenyl hydramine – antihistamine
(3) Omeprazole – antiseptic
(4) Phenacetin – antipyretic

98. An open vessel at 27°C is heated unit 3/8th of the air in it has been expelled. Assuming that the volume remains constant, calculate the temperature at which the vessel was heated
(1) 307°C (2) 107°C
(3) 480°C (4) 207°C

99. Which of the following reaction does not occur spontaneously between metal oxide(X) and reducing agent (Y) at the specified temperature?
(1) X = MgO; Y = Al at temperature of around 800K
(2) X = ZnO; Y = CO at temperatures of around 800 K
(3) X = FeO; Y = CO at temperatures of around 800 K
(4) Both 1 & 2

100. Equal moles of O_2 and H_2 gases are placed in container with a pin hole through which both can escape. What fraction of the H_2 escapes in the time required for one-eight of the O_2 to escape?
(1) $\frac{1}{4}$ (2) $\frac{1}{8}$
(3) $\frac{1}{2}$ (4) $\frac{3}{8}$

ZOOLOGY : SECTION-A

All questions are compulsory in section A

101. The atrio-ventricular valves of the heart are prevented from turning inside out by tough strands of connective tissue called
(1) chordae tendinae
(2) tricuspid valve
(3) semilunar valve
(4) mitral valve

102. To regulate the cardiac activity, neural signals through parasympathetic nerves can
(1) decrease the rate of heart beat
(2) decrease the speed of conduction of action potentials
(3) decrease the cardiac output
(4) all the above

103. Blood continues to enter the atria except during
(1) ventricular systole
(2) ventricular diastole
(3) atrial systole
(4) joint diastole

104. Which of the following group of animals belong to the same phylum ?
(1) Earthworm, Pinworm, Tapeworm
(2) Prawn, Scorpion, Locust
(3) Sponge, Sea anemone, Starfish
(4) Malarial Parasite, Amoeba, Mosquito

105. Which of these include only protochordates/ Acraniates?
(1) *Ascidia*, *Branchiostoma*, *Doliolum*
(2) *Ascidia*, *Myxine*, *Doliolum*
(3) *Herdmania*, *Petromyzon*, *Salpa*
(4) All of these are protochordates

106. Secretion of oothecal covering in *Periplaneta* is by __a__ gland and number of ootheca produced are __b__. What are a and b respectively?
(1) Mushroom gland, 9–10
(2) Phallic gland, 14–16
(3) Collaterial gland, 9 –10
(4) Gonapophyses, 16

107. Which of the following option is incorrect w.r.t. given diagram?

(1) Unique feature of phylum Cnidaria
(2) Present on body wall and tentacles of *Hydra*
(3) Helps in prey capturing, anchorage and defence in *Pleurobrachia*
(4) Both (1) and (2)

108. **Statement-I** : Lymph is an important carrier for nutrients and hormones.
Statement-II : Fats are absorbed through lymph in the lacteals present in the intestinal villi.
(1) Both statement-I and statement-II are correct
(2) Both statement-I and statement-II are incorrect
(3) Statement-I is correct but statement-II is incorrect
(4) Statement-I is incorrect but statement-II is correct

109. **Jointed legs, Antennae, 3 pairs of legs, Compound eyes, Coxal glands, Malpighian tubules, Chitinous Exoskeleton**
How many of these are found in *Locusta*?
(1) 5 (2) 7
(4) 4 (4) 6

110. Which of the following is an incorrect statement?
(1) Green glands help in excretion in crustacea
(2) Book lungs are present in some representatives of Arthropoda
(3) In aquatic arthropods excretory product is ammonia
(4) In insects nervous system consists of simple nerve net

111. Leakage of blood from pulmonary trunk & systemic aorta
a. causes heart murmur
b. is due to damage to semilunar valves
c. is due to damage to AV- valves
d. is caused by insufficient blood pressure.
(1) a & b (2) b & d
(3) c & d (4) a & c

112. Exclusively endoparasitic protozoan is
(1) *Paramecium* (2) *Amoeba*
(3) *Plasmodium* (4) none of these

113. Which of the followin is an incorrect statement?
(1) Lymph helps to return interstitial fluid to the blood
(2) Action potentials from atria must pass through the A-V node to reach the ventricles
(3) Tunica media is the thickest middle layer with smooth muscles and elastic fibres in the wall of arteries
(4) ECG cannot diagnose the abnormalities of conducting pathway

114. Which one of the following statements is incorrect?
(1) In cockroaches and prawns excretion of waste material occurs through malpighian tubules.
(2) In Ctenophora, locomotion is mediated by comb plates.
(3) In *Fasciola* flame cells take part in excretion
(4) Earthworms are hermaphrodites and yet cross fertilization takes place among them.

115. What is true w.r.t blood supply to liver?
(1) There is a unique vascular connection that starts from liver and ends in digestive system
(2) Hepatic portal vein carries blood from liver to heart
(3) Liver receives oxygenated blood from hepatic artery and deoxygenated blood from hepatic portal vein
(4) None of these

116. **Assertion** : Reptiles are predominantly terrestrial animals..
Reason : Reptiles have cornified exoskeleton and are mostly ureotelic
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion
(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
(3) Assertion is true statement but Reason is false
(4) Assertion is false

117. Which of the following statement is incorrect?
(1) Connective tissue is most abundant and widely distributed tissue in the body of complex animals.
(2) Special function of connective tissues is protection and secretion in the body.
(3) In most types of connective tissues, cells secrete fibres of structural proteins called collagen or elastin.
(4) Areolar connective tissue is an example of loose connective tissue found beneath the skin

118. Adult human RBCs are enucleated. Which of the following statement(s) is/are most appropriate explanation for this feature?
(a) They do not need to reproduce
(b) They are somatic cells
(c) They do not metabolize
(d) All their internal space is available for oxygen transport
(1) Only (d) (2) Only (a)
(3) (a), (c) and (d) (4) (b) and (c)

119. Fertilization and development in ctenophores is
(1) External, indirect
(2) External, direct
(3) Internal, direct
(4) Internal, indirect

120. How many of the following chordates are with hair, mammary glands and pinna?
Felis, Bufo, Chelone, Panthera tigris, Canis, Betta, Pterophyllum, Panthera leo
(1) 6 (2) 4
(3) 7 (4) 5

121. Which part/structure of cockroach does not match with its description
(1) Proventriculus – Has cuticular teeth for crushing food
(2) Crop – follows gizzard in the gut
(3) Mesenteron – is not lined by cuticle
(4) Hepatic caecae –secrete digestive juice

122. Which of the following group includes organisms that are able to regulate their body temperature?
(1) *Balaenoptera*, *Columba*, *Hippocampus*
(2) *Vipera*, *Pavo*, *Crocodilus*
(3) *Testudo*, *Chelone*, *Icthyophis*
(4) *Corvus, Pteropus, Aptenodytes*

123. 

The protein/ molecules at A, B and C are
(1) thrombokinase, thrombin and fibrin
(2) thrombokinase, Ca^{2+}, and fibrinogen
(3) thrombin, prothrombinase and fibrin
(4) Ca^{2+}, prothrombinase and fibrinogen

124. Match the column-I (Epithelial tissue) with column-II (Location in the body) and choose the correct option

Column-I	**Column-II**
a. Columnar epithelium	i. Tubular part of nephron
b. Compound epithelium	ii. Fallopian tube
c. Cuboidal epithelium	iii. Stomach & intestine
d. Ciliated epithelium	iv. Moist surface of buccal cavity

(1) a–ii, b–iv, c–iii, d–i (2) a–iii, b–iv, c–ii, d–i
(3) a–i, b–iii, c–ii, d–iv (4) a–iii, b–iv, c–i, d–ii

125 Mark the option with correct number of given structure in cockroach
(1) Phallomeres in male - 3 pairs
(2) Ovarioles in female - 16 pairs
(3) Gonapophysis in female - 3 pairs
(4) Collaterial glands - 2 pairs

126. Read the following characters. Enlist the correct ones w.r.t. amphibians
a. Skin is moist without scales
b. Eyelids absent
c. Cloaca present which opens to the exterior
d. Sexes united
e. Cold blooded
(1) a, b, c and d (2) a, b and d
(3) a, c and e (4) a, d and e

127. Blood passes from post caval to
(1) systolic left atrium
(2) systolic right atrium
(3) diastolic left atrium
(4) diastolic right atrium

128. Which of the feature is not present in Mollusca?
(1) Jointed appendages
(2) Radula, a rasping organ
(3) Feather-like gills
(4) Open circulatory system

129. Which of the following statement is incorrect?
(1) Goblet cells are modified columnar epithelial cells
(2) Some of the cuboidal and columnar cells are modified for secretion
(3) PCT is lined by simple cuboidal brushbordered epithelial tissue
(4) Alveoli and Bowmans capsule are lined by cells with cuboidal appearance

130. When the body of an animal can be divided into identical left & right halves only in one plane, symmetry is
(1) bilateral (2) biradial
(3) radial (4) spherical

131. A jawless fish, which lays eggs in fresh water and whose ammocoetes larvae after metamorphosis return to the ocean is :
(1) *Petromyzon*
(2) *Exocoetus*
(3) *Myxine*
(4) *Trygon*

132. A special case of Rh incompatibility has been observed between the _____ blood of a pregnant mother with _____blood of the foetus.
(1) Rh + ve, Rh – ve
(2) Rh + ve, Rh + ve
(3) Rh – ve, Rh + ve
(4) Rh – ve, Rh – ve

133. Match the following

a.	Angina	i.	Insufficient pumping of blood
b.	Heart failure	ii.	Deposition of calcium cholesterol in coronary arteries
c.	Atherosclerosis	iii.	Condition that affect blood flow to heart
d.	Hypertension	iv.	Affects vital organs like brain, kidneys

(1) a–iii, b–i, c–iv, d–ii
(2) a–i, b–iv, c–ii, d–iii
(3) a–iii, b–i, c–ii, d–iv
(4) a–ii, b–i, c–iv, d–iii

134. Select the correct route for the passage of sperms in male frogs :
(1) Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca
(2) Testes → Vasa efferentia → Kidney → Seminal Vesicle → Urinogenital duct → Cloaca
(3) Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca
(4) Testes → Vasa efferentia → Kidney → Bidders canal → Urinogenital duct → Cloaca

135. Cardiac output is
a. stroke volume + heart rate
b. volume of blood pumped by each ventricle per cardiac cycle
c. approximately 5000 mL
(1) b and c (2) a and b
(3) only c (4) a, b and c

ZOOLOGY : SECTION-B

This section has 15 questions, attempt any 10 questions of them.

136. Identify the phylum that consists of a small group of worm like marine animals with proboscis, collar and trunk
(1) Hemichordata (2) Urochordata
(3) Cephalochordata (4) All of these

137. A patch of nodal tissue present in right upper corner of right atrium is
(1) autoexcitable
(2) can generate maximum number of action potentials i.e. 70-75 times per minute
(3) responsible for initiating and maintaining the rhythmic contractile activity of heart
(4) all of these

138. If heart beats 80 beats per minute then what is the duration of each cardiac cycle.
(1) 0.70 sec (2) 0.75 sec
(3) 0.80 sec (4) 0.85 sec

139. How many statements are correct ?
a. Presence of scale less body and unpaired fins is feature of jawless vertebrates.
b. In birds oil gland is present at the base of forewing.
c. Scales in snakes and lizards are never shed in life time.
d. Reptiles are mostly oviparous and their development is direct.
e. The hind limbs in birds have scales which indicate their reptilian ancestry
(1) 1 (2) 2
(3) 3 (4) 4

140. **Statement-I** : All amphibians show presence of head & trunk without exception.
Statement-II : An operculum & cloaca is unique feature of cartilaginous fish.
(1) Both statement-I and statement-II are correct
(2) Both statement-I and statement-II are incorrect
(3) Statement-I is correct but statement-II is incorrect
(4) Statement-I is incorrect but statement-II is correct

141. Select the correct statement from the ones given below with respect to *Periplaneta americana*
(1) Nervous system located dorsally, consists of segmentally arranged ganglia joined by a pair of longitudinal connectives
(2) Males bear a pair of short thread like anal styles.
(3) There are 16 very long Malpighian tubules present at the junctions of midgut and hindgut
(4) Grinding of food is carried out only by the mandibles

142. Which of the following features is not present in *Periplaneta americana?*
(1) Metamerically segmented body
(2) Schizocoelom as body cavity
(3) Indeterminate and radial cleavage during embryonic development
(4) Exoskeleton composed of N-acetylglucosamine

143. A special system of blood vessels present in body exclusively for circulation of blood to and from cardiac masculature is
(1) hepatic portal circulation
(2) renal portal circulation
(3) coronary circulation
(4) systemic circulation

144. Following are the statements about prostomium of earthworm.
a. It serves as a covering for mouth
b. It helps to open cracks in the soil into which it can crawl
c. It is one of the sensory structures
d. It is the first body segment
Choose the correct answer from the options given below
(1) a, b & c are correct
(2) a, b & d are correct
(3) a, b, c & d are correct
(4) b & c are correct

145. How many among the following are true statement/
a. Lymphatic system drains back lymph back to major arteries
b. Lymph has same mineral distribution as that of plasma
c. Open circulatory system is present in arthropods and molluscs
d. Closed circulatory system is more advantageous as flow of fluid can be more precisely regulated
e. In fishes, the heart pumps out oxygenated blood to the body
(1) 2 (2) 3
(3) 4 (4) 5

146. A student prepared slides of transverse section of blood vessels. The labels on the slides got mixed up. He can recognise the T.S. artery through
a. wider lumen
b. thicker tunica media
c. cuboidal endothelial cells
d. narrower lumen
(1) a & b (2) b & c
(3) b & d (4) c & d

147. What will you look for to identify the sex of the following?
(1) Male shark - Claspers borne on pelvic fins
(2) Female *Ascaris* - Sharply curved posterior end
(3) Male frog - A copulatory pad on the first digit of the hind limb
(4) Female cockroach - Anal cerci

148. **Assertion** : Organ systems in different groups of animals exhibit various patterns of complexities.
Reason : The digestive system in Platyhelminthes has only a single opening to the outside and is hence called incomplete.
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion
(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
(3) Assertion is true statement but Reason is false
(4) Assertion is false

149. Pick out the correct match
(1) Albumin : Osmotic balance
(2) Globulin : Inflammatory reactions
(3) Serum : Plasma with clotting factors
(4) Fibrinogen : Defence

150. Which of the following statement is true ?
(1) Tight junctions help to allow substances from leaking across a tissue.
(2) Adhering junctions help in separation of neighbouring cells from each other.
(3) Gap junctions connect the cytoplasm of adjoining cells, for rapid transfer of ions and small molecules only.
(4) Specialised junctions provide both structural and functional links between cells.

BOTANY : SECTION-A

All questions are compulsory in section A

151. Reduced male gametophyte in gymnosperm is
(1) microsporangium (2) megaspore
(3) pollen grain (4) prothalial cell

152. Endosperm in Gymnosperms is formed
(1) after fertilization
(2) at the time of fertilization
(3) before fertilization
(4) inside microsporangia

153. *Equisetum*, commonly called horsetail is a member of
(1) Class bryopsida of bryophytes
(2) Class sphenopsida of pteridophytes
(3) Class pteropsida of pteridophytes
(4) Class bryopsida of pteridophytes

154. Which of the following statement is incorrect w.r.t. gymnosperms?
(1) Ovules are enclosed by ovary wall
(2) They include medium sized trees, tall trees and shrubs
(3) Seeds remain exposed after fertilization
(4) Leaves are well-adapted to withstand extremes of temperature, humidity and wind

155. Heterosporous ferns are
(1) *Marsilea, Salvinia* and *Azolla*
(2) *Marsilea*, *Salvinia* and *Dryopteris*
(3) *Lycopodium*, *Selaginella* and *Dryopteris*
(4) *Marsilea*, *Salvinia* and *Selaginella*

156. Which of the following features of maize leads to resistance against stem borers?
(1) High aspartic acid high N_2 and low sugar
(2) Low aspartic acid, high iron and sugar
(3) High aspartic acid, low iron and sugar
(4) High aspartic acid, low N_2 and sugar

157. How many of the following plants have free living gametophyte?
Funaria, Pinus, Sphagnum, Dryopteris, Adiantum, Sequoia
(1) 4 (2) 5
(3) 3 (4) 6

158. *Marchantia* is characterised by all except
(1) dorsiventral symmetry
(2) dichotomous branching
(3) two rows of tiny leaf-like appendages
(4) unicellular unbranched rhizoids

159. Protonema of a moss is
(1) leafy stage of gametophyte
(2) flat, heart-shaped structure
(3) juvenile, filamentous stage
(4) dominant phase of life cycle

160. Select the correct statement w.r.t. algae
(1) Algae are largely terrestrial
(2) Mechanical tissues and vascular tissues are well developed
(3) Reproduction occurs by zoospores only
(4) Chloroplast lack grana

161. Resistance to yellow mosaic virus in bhindi was transferred from a wild species and resulted in a new variety called
(1) Pusa komal (2) Pusa sadabahar
(3) Parbhani kranti (4) Pusa swarnim

162. In ferns, meiosis occurs inside
(1) antheridium (2) archegonium
(3) zygote (4) sporangium

163. Which of the following is not an objective of Biofortification in crops?
(1) Improve protein content
(2) Improve resistance to diseases
(3) Improve vitamin content
(4) Improve micronutrient and mineral content

164. Which of the following statements is wrong for SCP?
(1) Microbes like *Spirulina* are easily grown on materials like animal manure and even sewage
(2) They provide an alternate source of proteins for animal and human nutrition
(3) Their production cost is high
(4) It reduces environmental pollution

165. *Pinus* seed cannot germinate and established without fungal association. This is because
(1) its embryo is immature
(2) it has obligate association with mycorrhizae
(3) it has very hard seed coat
(4) its seeds contain inhibitors that prevent germination

166. Pteridophyte differ from bryophytes in having
(1) rhizoids
(2) dependent gametophyte
(3) vascular tissue
(4) foot, seta and capsule in sporophyte

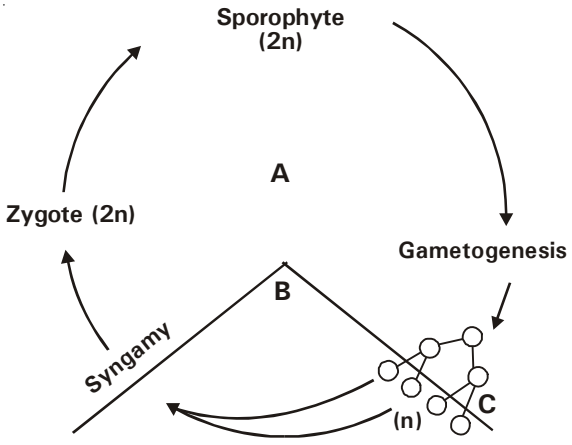
167. The entire collection having all the diverse alleles for all genes in a given crop is
(1) germplasm collection
(2) cryopreservation
(3) seed bank
(4) tissue culture

168. Identify the group on the basis of following features
a. found in cool, damp & shaded areas
b. main plant body is sporophyte
c. presence of vascular tissues
(1) bryophyta
(2) pteridophyta
(3) gymnosperms
(4) algae

169. Pollination in gymnosperms is
(1) anemophilous and direct
(2) anemophilous and indirect
(3) hydrophilous and direct
(4) hydrophilous and indirect

170. Which is the most crucial step for the success of breeding programme?
(1) Selection of parents
(2) Selection and testing of superior recombinants
(3) Collection of variability
(4) Cross hybridisation of two different plants

171. Identify following life cycle and fill A, B, C correctly



(1) Haplontic, A–Sporophytic phase, B– Gametophytic phase, C–Meiosis
(2) Diplontic, A–Sporophytic phase, B– Gametophytic phase, C–Meiosis
(3) Diplontic, A–Sporophytic phase, B– Gametophytic phase, C–Mitosis
(4) Haplontic, A– Gametophytic phase, B–Sporophytic phase,C–Meiosis

172. Xylem & phloem in pteridophytes
(1) have vessels & sieve tubes respectively
(2) have trachieds & sieve tubes respectively
(3) lack trachieds & sieve tubes respectively
(4) lack vessels & sieve tubes respectively

173. Gemma are present in
(1) some liverworts
(2) mosses
(3) pteridophytes
(4) some gymnosperms

174. Prothallus of *Dryopteris* is
(1) Cordate and unicellular
(2) Photosynthetic and multicellular
(3) Cordate and dioecious
(4) Non-photosynthetic and monoecious

175. Phylogenetic system of classification is based on
(1) morphological features
(2) chemical constituents
(3) floral characters
(4) evolutionary relationships

176. **Statement- I** : Agriculture accounts for approximately 62 per cent of India's GDP and employs nearly 33 per cent of the population.
Statement- II : During the period 1960 to 2000, wheat production increased from 11 to 75 million tonnes while rice production went up from 35 to 89.5 million tonnes.
(1) Both statement -I and statement- II are correct
(2) Both statement-I and statement-II are incorrect
(3) Statement-I is correct but statement-II is incorrect
(4) Statement-I is incorrect but statement- II is correct

177. Identify the plant in the following diagram

(1) *Cycas* (2) *Pinus*
(3) *Ginkgo* (4) Mango

178. Semi-dwarf rice varieties developed in India are
(1) Sonalika, Kalyan Sona
(2) Jaya, Ratna
(3) *Oryza nivara*
(4) *Saccharum spontaneum*

179. Pusa Gaurav is a resistant variety of *Brassica* released by IARI New Delhi. This variety is resistant against
(1) aphids
(2) jassid
(3) shoot and fruit borers
(4) all of these

180. Which of the following statement is incorrect?
(1) *Laminaria,* a red algae has holdfast, stipe & frond.
(2) Gametophyte of liverwort is totally independent of sporophyte
(3) Most reduced & dependent gametophyte is seen in angiosperm
(4) Heterosporous pteridophytes produce dioecious gametophytes.

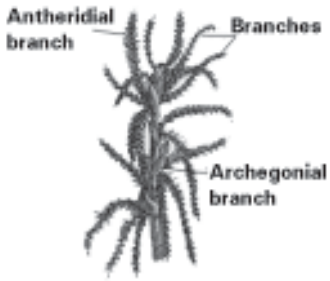
181. Match the column I and II and select the correct option

	Column-I		**Column-II**
a.	Vitamin enriched vegetables	i.	Tissue culture
b.	*Methylophilus methylotropus*	ii.	Somatic hybridization
c.	Somaclones	iii.	IARI
d.	Pomato	iv.	SCP

(1) a–iii, b–iv, c–i, d–ii (2) a–iii, b–i, c–ii, d–iv
(3) a–iv, b–i, c–iii, d–ii (4) a–iv, b–iii, c–i, d–ii

182. Hydrocolloid carrageen is obtained from
(1) Chlorophyceae and Phaeophyceae
(2) Phaeophyceae and Rhodophyceae
(3) Rhodophyceae only
(4) Phaeophyceae only

183. Identify the following plant and to which group it belongs respectively



(1) *Sphagnum*, liverworts
(2) *Funaria,* moss
(3) *Marchantia,* liverworts
(4) *Sphagnum*, moss

184. **Assertion** : Bryophytes are called amphibians of plant kingdom
Reason : Bryophytes are found in soil but are dependent on water for sexual reproduction.
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion
(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion
(3) Assertion is true statement but Reason is false
(4) Assertion is false

185. The development of embryo in bryophytes takes place inside the
(1) protonema
(2) archegonium
(3) antheridium
(4) sporogonium

BOTANY : SECTION-B

This section has 15 questions, attempt any 10 questions of them.

186. What type of plant is *Pinus*?
(1) Homosporous, monoecious
(2) Heterosporous, dioecious
(3) Heterosporous, monoecious
(4) Homosporous, dioecious

187. Which of the folowing is incorrect w.r.t. *Cycas* ?
(1) Presence of coralloid roots
(2) Presence of circinate ptyxis
(3) Winged pollen grains
(4) Absence of female cones

188. Strobilus is the reproductive structure in
(1) *Selaginella* & *Marchantia*
(2) *Equisetum* and *Dryopteris*
(3) *Pteris* & *Adiantum*
(4) *Selaginella* & *Equisetum*

189. **Statement- I** : The main dominant phase in the life cycle of pteridophytes is spore bearing, diploid sporophyte.
Statement- II : The pteridophytes include liverworts and ferns.
(1) Both statement -I and statement- II are correct
(2) Both statement-I and statement-II are incorrect
(3) Statement-I is correct but statement-II is incorrect
(4) Statement-I is incorrect but statement- II is correct

190. How many structures listed below are diploid for a typical fern member?
a. Leafcell b. Rhizome
c. Archegonium d. Sporophyll cell
e. Prothallus cell f. Zygote
g. Spore
(1) Three
(2) Six
(3) Four
(4) Seven

191. Father of green revolution in India is
(1) Norman Borlaug
(2) Ramdeo Mishra
(3) M.S. Swaminathan
(4) Tansley

192. Match the class of algae in column-I with the corresponding stored food in column-II

Column-I		**Column-II**	
a.	Chlorophyceae	p.	Mannitol, laminarin
b.	Phaeophyceae	q.	Starch
c.	Rhodophyceae	r.	Floridean starch

(1) a-p, b-r, c-q
(2) a-r, b-p, c-q
(3) a-q, b-p, c-r
(4) a-r, b-q, c-p

193. Bryophytes resemble algae on the following basis
(1) differentiation of the plant body into root, stem and heterotrophic mode of nutrition
(2) thallus like plant body, lack of vascular tissue, absence of root and having autotrophic mode of nutrition
(3) thallus-like plant body, presence of roots, and heterotrophic mode of nutrition
(4) filamentous body, presence of vascular tissue, and autotrophic mode of nutrition

194. Leafy stage of a moss gametophyte consists of a
(1) upright, slender axis
(2) prostrate, filamentous stage
(3) dorsiventral thalloid form
(4) horizontal, slender axis

195. Evolutionarily, first terrestrial plants to possess vascular tissues are
(1) algae
(2) bryophytes
(3) pteridophytes
(4) gymnosperms

196. Which of the following does not belong to chlorophyceae?
(1) *Chara*
(2) *Ulothrix*
(3) *Ectocarpus*
(4) *Volvox*

197. **Assertion** : Tissue culture technique is used to recover healthy plants from diseased plants by doing meristem culture

Reason : The apical and axillary meristems are the parts where virus growth is maximum

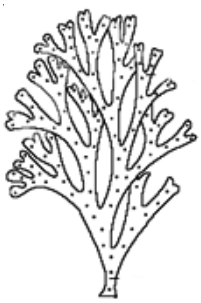
(1) Both Assertion and Reason are true and the reason is the correct explanation of the assertion

(2) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion

(3) Assertion is true statement but Reason is false

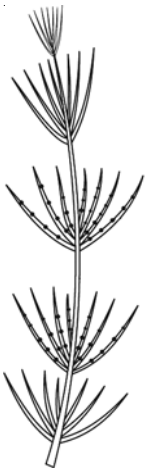
(4) Assertion is false

198. Observe the following diagram carefully and identify the member with algin in its cell wall.

(1) 

(2) 

(3) 

(4) 

199. Plants obtained by protoplast culture called somatic hybrid because

(1) it is the fusion of two germ cells of two plants

(2) it is a fusion of protoplast of two somatic cell of different varieties of plants

(3) it is the fusion of germ or somatic cells of same variety of plants

(4) it is the fusion of two meristematic cell of same variety of plants

200. How many statements are false?

(1) Conventional breeding is often constrained by availability of limited number of disease resistance genes

(2) In mung beans, resistance to yellow mosaic virus was introduced by mutations

(3) Gamma radiations are often used to induce mutations in plants

(4) Somatic hybridization involves cross pollination

(1) One (2) Two

(3) Three (4) Four