NEET (UG) 2024

SAMPLE PAPER - 7

Time Allowed: 3 hours and 20 minutes **Maximum Marks: 720**

General Instructions:

- The test is of 3 hours and 20 minutes and it contains 200 questions. Internal choice is given within the sections.
- For each correct response, the candidate will get 4 marks.
- For each incorrect response, one mark will be deducted from the total scores.
- The maximum marks are 720.

PHYSICS (Section-A)

1. If I, R and t represent current, resistance and time respectively, then the dimensions of I^2Rt are **[4]**

   a) $[ML^{-1}]$ b) $[M^0L^0T^2]$

   c) $[M^1L^2T^{-2}]$ d) $[M^1L^1T^{-2}]$

2. In the following T refers to current and other symbols have their usual meaning, Choose the option that corresponds to the dimensions of electrical conductivity: **[4]**

   a) $M^{-1}L^{-3}T^3I^2$ b) $ML^{-3}T^{-3}I^2$

   c) $M^{-1}L^{-3}T^3I$ d) $M^{-1}L^3T^3I$

3. Curved lines in velocity-time graph for a particle in a given interval of time implies **[4]**

   a) work done b) non-uniform acceleration

   c) distance d) velocity

4. If a particle moves in a circle, describing equal angles in equal times, its velocity vector: **[4]**

   a) changes in direction b) changes both in magnitude and direction

   c) remains constant d) changes in magnitude

5. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the **[4]**

projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) is: (Given g = $9.8ms^{-2}$)

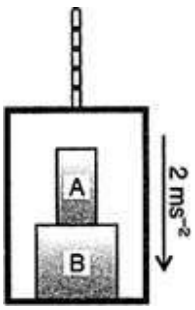
a) 16.3

b) 5.9

c) 3.5

d) 110.8

6. The elevator shown in the figure is descending, with an acceleration of 2 ms^{-2}. The mass of the block A = 0.5 kg. The force exerted by the block A on the block B is: **[4]**



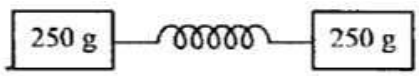
a) 6 N

b) 2 N

c) 4 N

d) 8 N

7. As per the given figure, two blocks each of mass 250g are connected to a spring of spring constant 2 Nm^{-1}. If both are given velocity v in opposite directions, then maximum elongation of the spring is: **[4]**



a) $\frac{v}{\sqrt{2}}$

b) $\frac{v}{2}$

c) $\frac{v}{2\sqrt{2}}$

d) $\frac{v}{4}$

8. Two spheres of equal mass, one at rest with each other. The collision is absolutely elastic but not central. Then the angle between the final velocities **[4]**

a) $0 \leq 180°$

b) $90° \leq \theta \leq$

c) $\theta = 180°$

d) $\theta = 90°$

9. Two wheels are connected by a belt. The radius of larger wheel is three times that of the smaller one. What is the ratio of the rotational inertia of larger wheel to the smaller wheel, when both wheels have same angular momentum? **[4]**

a) 3 b) 12

c) 9 d) 6

10. Moment of inertia of a body about a given axis is 1.5 kg m^2. Initially, the body is at rest. In order to produce a rotational kinetic energy of 1200 J, the angular acceleration of 20 rad/s^2 must be applied about the axis for a duration of **[4]**

a) 2 s b) 3 s

c) 5 s d) 2.5 s

11. The earth is assumed to be a sphere of radius R. A platform is arranged at a height R from the surface of the earth. The escape velocity of a body from this platform is fv, where v is its escape velocity from the surface of the earth. The value of f is: **[4]**

a) $\frac{1}{2}$ b) $\frac{1}{3}$

c) $\sqrt{2}$ d) $\frac{1}{\sqrt{2}}$

12. Which of the following statements is correct? **[4]**

a. The basic reason for elasticity is interatomic force and strain energy in the material of a body is stored in the form of interatomic energy.

b. Young's modulus of elasticity of a body depends on the longitudinal stress applied to it.

c. Young's modulus of elasticity of a bo4y depends upon its size.

d. None of the above

a) Only (d) b) Only (c)

c) Only (a) d) Only (b)

13. A black body at 227^oC radiates heat at the rate of 7 cal/cm^2. At a temperature of 727^oC, the rate of heat radiated in the same units will be: **[4]**

a) 50 b) 80

c) 60 d) 112

14. When a metal rod is heated it expands because: **[4]**

i. the size of its atoms increases

ii. the distance among its atoms increases

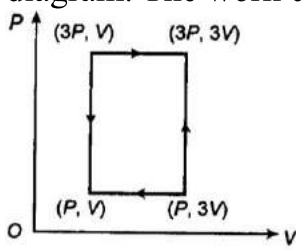
iii. atmospheric air rushes into it

iv. the actual cause is still unknown

a) i and ii b) iii and iv

c) only ii d) iv and i

15. An ideal monoatomic gas is taken round the cycle ABCOA as shown in following P-V diagram. The work done during the cycle is: **[4]**



a) 4 PV b) 2 PV

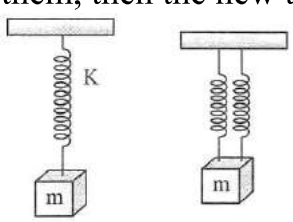
c) Zero d) PV

16. In the isothermal expansion of 10g of gas from volume V to 2V the work done by the gas is 575J. What is the root mean square speed of the molecules of the gas at that temperature? **[4]**

a) 520m/s b) 398m/s

c) 532m/s d) 499m/s

17. A mass m performs oscillations of period T when hanged by spring of force constant k. If spring is cut in two parts and arranged in parallel and same mass is oscillated by them, then the new time period will be: **[4]**



a) $\frac{T}{\sqrt{2}}$

b) 2T

c) T

d) $\frac{T}{2}$

18. The velocities of sound in an ideal gas at temperatures T_1 and T_2 K are found to be V_1 and V_2 respectively. If the root mean square speeds of the same gas at the same temperatures T_1 and T_2 are V_1 and v_2 respectively, then: **[4]**

a) $v_2 = v_1 (V_2/V_1)$

b) $v_2 = v_1\sqrt{V_1/V_2}$

c) $v_2 = v_1\sqrt{V_2/V_1}$

d) $v_2 = v_1 (V_1/V_2)$

19. The musical interval between two tones of frequencies 320 Hz and 240 Hz is: **[4]**

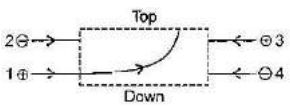
a) 320 × 240

b) 80

c) $(\frac{4}{3})$

d) 560

20. The path of a positively charged particle 1 through a rectangular region of uniform electric field is as shown in the figure. What is the direction of electric field and the direction of deflection of particles 2, 3 and 4? **[4]**



a) Down, top, down, down

b) Top, down, top, down

c) Top, down, down, top

d) Down, top, top, down

21. Three capacitors of capacitances 12 μF each are available. The minimum and maximum capacitances which may be obtained from these are: **[4]**

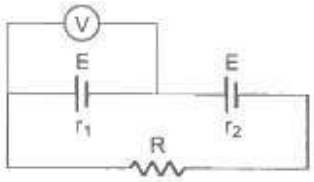
a) $4\mu F, 12\mu F$

b) $12\mu F, 36\mu F$

c) $4\mu F, 36\mu F$

d) $0\mu F, \infty\mu F$

22. In the following figure, the reading of an ideal voltmeter V is zero. Then, the relation between R, r_1 and r_2 is: **[4]**



a) $R = r_2 - r_1$

b) $R = r_1 + r_2$

c) $R = r_1 - r_2$

d) $R = \frac{r_1 r_2}{r_2 + r_1}$

23. A circular current loop of magnetic moment M is in an arbitrary orientation in an external magnetic field $\vec{B}$. The work is done to rotate the loop by 30° about an axis perpendicular to its plane is: **[4]**

a) MB

b) $\sqrt{3}\frac{MB}{2}$

c) Zero

d) $\frac{MB}{2}$

24. The tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces deflections of 60^o and 45^o respectively. The ratio of the number of turns in the coil is: **[4]**

a) $\frac{(\sqrt{3}+1)}{1}$

b) $\frac{\sqrt{3}}{1}$

c) $\left(\frac{\sqrt{3}+1}{\sqrt{3}-1}\right)$

d) $(\frac{4}{3})$

25. A vibration magnetometer placed in a magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in the Earth's horizontal magnetic field of 24 microteslas. When a horizontal field of 18 microteslas is produced opposite to the Earth's field by placing a current-carrying wire, the new time period of the magnet will be: **[4]**

a) 4 s

b) 1 s

c) 3 s

d) 2 s

26. The mutual inductance between two coils depends upon _____. **[4]**

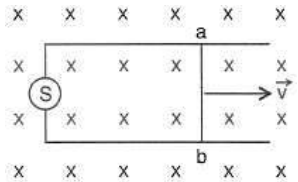
a) both medium between the coils and separation between coils

b) medium between the coils

c) neither medium between the coils nor separation between coils

d) separation between coils

27. The following diagram shows a wire ab of length l and resistance R sliding on a smooth pair of rails with a velocity v towards right. A uniform magnetic field of induction B acts normal to the plane containing the rails and the wire inwards. S is a current source providing a constant current I in the circuit. Then, the potential difference between a and b is: **[4]**



a) Bvl

b) IR

c) Bvl + IR

d) Bvl - IR

28. An AC voltage source E = $200\sqrt{2}$ sin 100t is connected across a circuit containing an AC ammeter and capacitor of capacity 1μF. The reading of ammeter is: **[4]**

a) 20 mA

b) 40 mA

c) 80 mA

d) 10 mA

29. If μ_0 is permeability of free space and ε_0 is permittivity of free space, the speed of light in vacuum is given by: **[4]**

a) $\sqrt{\mu_0\varepsilon_0}$

b) $\sqrt{\frac{1}{\mu_0\varepsilon_0}}$

c) $\sqrt{\frac{\varepsilon_0}{\mu_0}}$

d) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$

30. A mirror 1 m high hangs on a wall. A man stands at a distance 2 m away from the mirror. What is the height of the portion of the opposite wall in the room that can be seen by the man in the mirror without changing the position of his head? (The wall is 4 m from the mirror.) **[4]**

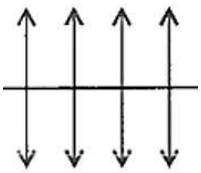
a) 2 metres

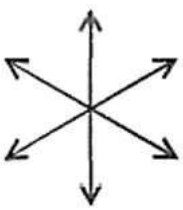
b) 3 metres

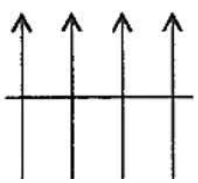
c) 1 metres

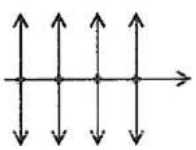
d) 4 metres

31. Which figure shows the polarised light? **[4]**

a) 

b) 

c) 

d) 

32. In a photoelectric effect experiment, the graph of stopping potential V versus reciprocal of wavelength obtained is shown in the figure. As the intensity of incident radiation is **[4]**

increased:

a) Slope of the straight line get more steep

b) Straight-line shifts to left

c) Graph does not change

d) Straight-line shifts to right

33. The photoelectric threshold wavelength for potassium (work function being 2 eV) is: **[4]**

a) 2100 nm

b) 620 nm

c) 1200 nm

d) 310 nm

34. The required energy to detach one electron from the Balmer series of hydrogen spectrum is: **[4]**

a) -1.5 eV

b) 3.4 eV

c) 10.2 eV

d) 13.6 eV

35. The activity of a radioactive element decreased to one-third of the original activity I_0 in a period of nine years. After a further lapse of nine years its activity will be: **[4]**

a) $\frac{I_0}{9}$

b) I_0

c) $(\frac{2}{3})I_0$

d) $\frac{I_0}{6}$

PHYSICS (Section-B)

Attempt any 10 questions

36. If g is the acceleration due to gravity on the Earths surface, the gain in the potential energy of an object of mass m raised from the surface of Earth to a height equal to the radius of the Earth R, is: **[4]**

a) 1
$\frac{1}{4}mgR$

b) 1
$\frac{1}{2}mgR$

c) 2mgR

d) mgR

37. Two bodies with masses m_1 and m_2 ($m_1 > m_2$) are joined by a string passing over a fixed pulley. The centres of gravity of the two masses are initially at the same height. Assume masses of the pulley and weight of the thread negligible. The acceleration of the centre of mass of m_1 and m_2 is: **[4]**

a) $\frac{m_1 g}{m_1 + m_2}$

b) $\left(\frac{m_1 - m_2}{m_1 + m_2}\right)^2 g$

c) $\frac{m_2 g}{m_1 + m_2}$

d) $\frac{m_1 - m_2}{m_1 + m_2} g$

38. Consider the following statements and select the correct statement(s). **[4]**

i. Gravitational force may be attractive or repulsive.

ii. Gravitational force between two particles is independent of presence of other particles.

iii. Gravitational force is a short-range force.

a) (ii) and (iii)

b) (i), (ii), and (iii)

c) (i) only

d) (ii) only

39. The volume of a metal sphere increases by 0.24% when its temperature is raised by 40^oC. The coefficient of linear expansion of the metal is _____/ ^oC. **[4]**

a) 18×10^{-5}

b) 1.2×10^{-5}

c) 2×10^{-5}

d) 6×10^{-5}

40. When a tuning fork vibrates, waves produced in the prongs are: **[4]**

a) longitudinal and stationary

b) transverse and progressive

c) transverse and stationary

d) longitudinal and progressive

41. A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be **[4]**

a) 1372 Hz

b) 1412 Hz

c) 1454 Hz

d) 1332 Hz

42. A coil of one turn is made of a wire of a certain length and then from the same length, a coil of two turns is made. If the same current is passed in both cases, then the ratio of the magnetic induction at their centres will be: **[4]**

a) 1:2

b) 4:1

c) 2:1

d) 1:4

43. If a bar magnet is placed with its south pole pointing towards geographic south in magnetic meridian, then the neutral points are located: **[4]**

a) along the axis of the magnet

b) at the angle of 45° with the magnetic axis

c) on the line perpendicular to the axis of the magnet

d) at the middle point of the magnet

44. A rod with circular cross-section area 2 cm^2 and length 40 cm is wound uniformly with 400 turns of an insulated wire. If a current of 0.4 A flows in the wire windings, the total magnetic flux produced inside windings is $4\pi \times 10^{-6}$ Wb. The relative permeability of the rod is (Given: Permeability of vacuum $\mu_0 = 4\pi \times 10^{-7}$ NA^{-2}) **[4]**

a) $\frac{5}{16}$

b) 12.5

c) 125

d) $\frac{32}{5}$

45. A step-down transformer transforms a supply line voltage of 2200 volt into 220 volt. The primary coil has 5000 turns. The efficiency and power transmitted by the transformer are 90% and 8 kilowatt respectively. Then, the number of turns in the secondary is: **[4]**

a) 50 b) 5

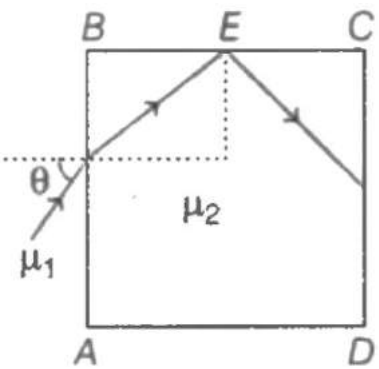
c) 5000 d) 500

46. A ray of light is incident on a glass slab ($\mu = 1.5$), thickness t, in such a manner that the angle of refraction is 60^{o}. If the speed of light in vacuum is c, then the time taken to cross the slab will be: **[4]**

a) $\frac{3t}{2c}$ b) $\frac{2t}{c}$

c) $\frac{3t}{c}$ d) $\frac{t}{c}$

47. A transparent cube of side d, made of a material of refractive index μ_2 is immersed in a liquid of refractive index $\mu_1 (\mu_1 < \mu_2)$. A ray is incident on the face AB at an angle θ (shown in the figure). Total internal reflection takes place at point E on the face BC. Then, θ must satisfy **[4]**



a) $\theta < \sin^{-1}\sqrt{\frac{\mu_2^2}{\mu_1^2} - 1}$

b) $\theta > \sin^{-1}\frac{\mu_1}{\mu_2}$

c) $\theta < \sin^{-1}\frac{\mu_1}{\mu_2}$

d) $\theta > \sin^{-1}\sqrt{\frac{\mu_2^2}{\mu_1^2} - 1}$

o **[4]**

48. The de Broglie wavelength and kinetic energy of a particle is 2000 A and 1 eV respectively. If its kinetic energy becomes 1 MeV, then its de Broglie wavelength is:

a) o
1 A

b) o
5 A

c) o
2 A

d) o
4 A

49. Mercury vapour lamp gives: **[4]**

a) band spectrum

b) continuous spectrum

c) line spectrum

d) absorption spectrum

50. Plutonium decays with a half-life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is **[4]**

a) $\frac{1}{8}$

b) $\frac{1}{2}$

c) $\frac{1}{4}$

d) $\frac{1}{3}$

CHEMISTRY (Section-A)

51. Aluminium metal generates hydrogen gas when dropped into 6 M HCl solution. Calculate the mass of H_2 that will form from the complete reaction of 0.355 g Al with excess of 6 M HCl. **[4]**

a) 7.88×10^{-2} g

b) 3.93×10^{-2} g

c) 4.81×10^{-2} g

d) 2.70×10^{-2} g

52. Which of the following particles has more electrons than neutrons? **[4]**

a) Al^{+3}

b) F^{-}

c) C

d) O^{-2}

53. Consider the following statements. **[4]**
Statement-1: Fluorine does not form any polyhalide as it has low F—F bond energy.
Statement-2: The chlorine has the most negative electron gain enthalpy.
Statement-3: The first ionization potentials of N and 0 atoms are 14.6 and 13.6 eV respectively.
Which of the above statements are correct?

a) Statements 1 and 3

b) Statements 2 and 3

c) Statements 1, 2 and 3

d) Statements 1 and 2

54. sp^3d^2 Hybridisation is not displayed by: **[4]**

a) PF_5

b) $[CrF_6]^{3-}$

c) BrF_5

d) SF_6

55. Select pair of anions in which both have same $O - \hat{X} - O$ bond angle. **[4]**

a) ClO_3^- , BrO_3^-

b) ClO_3^- , ClO_4^-

c) $IO3^-$, $ClO3^-$

d) $IO4^-$, $ClO4^-$

56. Which of the following contains both electrovalent and covalent bonds? **[4]**

a) CH_4

b) NH_4Cl

c) NH_2Cl_4

d) H_2O_2

57. For the reaction, $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ at constant temperature $\Delta H - \Delta E$ is: **[4]**

a) -RT

b) +3RT

c) -3RT

d) +RT

58. 50% neutralisation of a solution of formic acid ($K_a = 2 \times 10^{-4}$) with NaOH would result in a solution having a hydrogen ion concentration of: **[4]**

a) 3.7 M

b) 2.7 M

c) 1.85 M

d) 2×10^{-4} M

59. In which of the following reactions H_2O_2 acts as a reducing agent? **[4]**

i. $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O_2$

ii. $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$

iii. $H_2O_2 + 2e^- \rightarrow 2OH^-$

iv. $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

a) (iii), (iv)

b) (i), (iii)

c) (iii), (i)

d) (ii), (iv)

60. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified $KMnO_4$ for complete oxidation: **[4]**

a) $FeSO_3$

b) FeC_2O_4

c) $FeSO_4$

d) $Fe(SO_2)_2$

61. Cyclic silicone is prepared by controlled hydrolysis of: **[4]**

a) $(CH_3)_2SiCl_2$

b) CH_3SiCl_3

c) $(CH_3)_3SiCl$

d) mixture of CH_3SiCl_3 and $(CH_3)_3SiCl$

62. Which of the following is NOT an ore of aluminium? **[4]**

a) Corundum

b) Cryolite

c) Mica

d) Colemanite

63. A compound with molecular formula $C_4H_{10}O$ shows _____ number of alcoholic isomers. **[4]**

a) 2

b) 5

c) 4

d) 3

64. Decarboxylation of isobutyric acid yields _____. **[4]**

a) isopentane

b) n-propane

c) n-butane

d) isobutane

65. Diphenyl is an example of _____ compound. **[4]**

a) benzenoid

b) saturated

c) non-benzenoid

d) acyclic

66. Pure water boils at -99.725°C at Shimla. If K_b for water is 0.51 K mol^{-1} kg, the boiling point of 0.69 molal urea solution will be: **[4]**

a) 100.35

b) 96.37

c) 99.37

d) 100.08

67. The depression in f.p. of 0.01 m aqueous solution of urea, sodium chloride and sodium sulphate is in the ratio: **[4]**

a) 1 : 2 : 4

b) 1 : 2 : 3

c) 2 : 2 : 3

d) 1 : 1 : 1

68. Which one of the following pairs of substances on reaction will not evolve H_2 gas? **[4]**

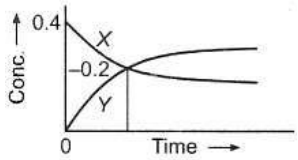
a) Iron and steam

b) Sodium and ethyl alcohol

c) Copper and $HCl_{(aq)}$

d) Iron and $H_2SO_{4(aq)}$

69. The accompanying figure depicts the change in concentration of species X and Y for the reaction X ⟶ F, as a function of time. The point of intersection of the two curves represents: **[4]**



a) $\frac{2}{3}t$

b) $\frac{3}{4}t$

c) Data is insufficient to predict

d) $\frac{1}{2}t$

70. For the reaction of H_2 with I_2, the rate constant is 2.5×10^{-4} dm^3 $mol^{-1}s^{-1}$ at 327°C and 1.0 dm^3 mol^{-1} s^{-1} at 527°C. The activation energy for the reaction, in kJ mol^{-1} is ($R = 8.314$ JK^{-1} mol^{-1}) **[4]**

a) 166

b) 72

c) 150

d) 59

71. Which of the following exhibits only +3 oxidation state? **[4]**

a) Ac

b) Pa

c) U

d) Th

72. Which of the following does not give two acids on dissolving in H_2O? **[4]**

a) $POCl_3$

b) C_3O_2

c) NO_2

d) P_4O_8

73. In nitroprusside ion, the iron exists as Fe^{2+} and NO as NO^+ rather than Fe^{3+} and NO respectively. **[4]**

These forms of ions are established with the help of:

a) magnetic moment in solid state

b) by reaction with KCN

c) thermal decomposition method

d) by action with K_2SO_4

74. Hybridization involved in the complex $[Ni(CN)_4]^{2-}$ is _____. (At No. of Ni = 28) **[4]**

a) d^2sp^3

b) sp^3

c) dsp^2

d) d^2sp^2

75. $\left[Ni(CN)_4\right]^{2-}$ and $\left[NiCl_4\right]^{2-}$ have similarity but not in: **[4]**

a) C.N. and O.N.

b) magnetic moment

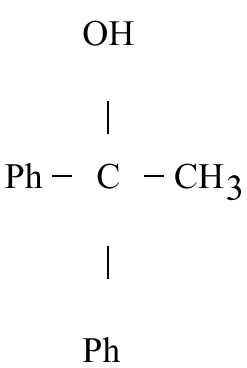
c) both magnetic moment and structure

d) structure

$$H_3^{\oplus}O$$ **[4]**

76. $PhMgBr + H_3C - C \equiv N \rightarrow$ Product:

a)



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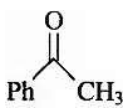

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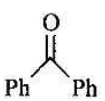

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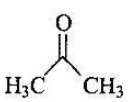


77. Reaction of phenol with chloroform in presence of dilute sodium hydroxide finally introduces which one of the following functional groups? **[4]**

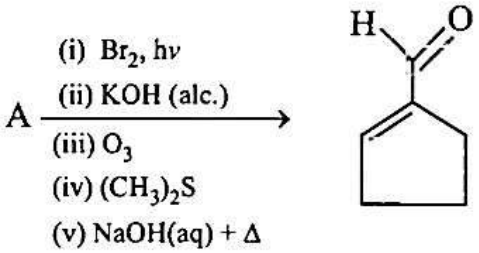
a) -COOH

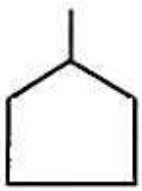
b) $-CH_2Cl$

c) -CHO

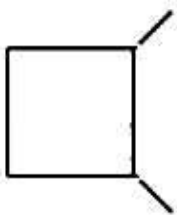
d) $-CHCl_2$

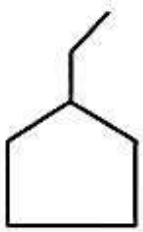
78. In the following reaction A is: **[4]**



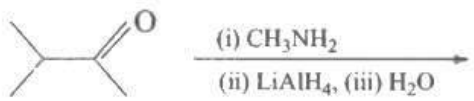
a) 

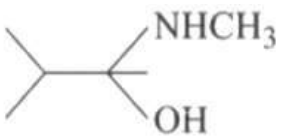
b) 

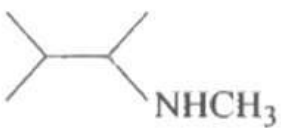
c) 

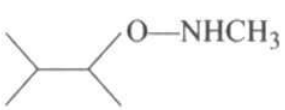
d) 

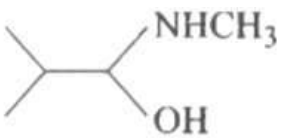
79. The major organic product formed from the following reaction is _____. **[4]**



a) 

b) 

c) 

d) 

80. Glucose when heated with CH_3OH in presence of dry HCl gas gives α and β-methyl glycosides because of mainly: **[4]**

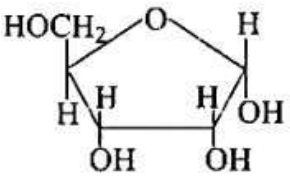
a) α—CHO group

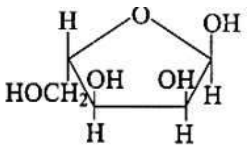
b) pyranose structure

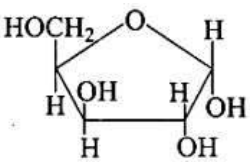
c) a CH_2OH group

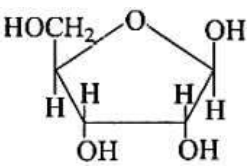
d) five hydroxyl groups

81. Which of the following represents the anomer of compound shown? **[4]**



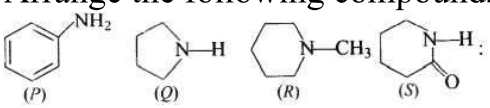
a) 

b) 

c) 

d) All of these

82. Arrange the following compounds in decreasing order of acidity **[4]**



a) S > P > R > Q

b) P > Q > R > S

c) S > P > Q > R

d) R > Q > P > S

83. The molar conductivity of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91 S cm^2mol^{-1} respectively. The molar conductivity of CH_3COOH at infinite dilution is: **[4]**

a) 698.28 S cm^2 mol^1

b) 390.71 S cm^2 mol^1

c) 201.28 S cm^2 mol^1

d) 540.48 S cm^2 mol^1

84. The Lassaigne's extract of sulphanilic acid may contain _____. **[4]**

a) NaCN, Na_2S and NaSCN

b) only NaCN

c) both NaCN and Na_2S

d) only Na_2S

85. When acetic acid and $K_4[Fe(CN)_6]$ is added to a copper salt, a chocolate precipitate is obtained of the compound? **[4]**

a) Copper ferrocyanide

b) Basic copper sulphate

c) Copper cyanide

d) Basic copper cyanide

CHEMISTRY (Section-B)

Attempt any 10 questions

86. Which of the following does not show hydrogen bonding? **[4]**

a) H_2S

b) N_2O

c) Fe_3O_4

d) H_2O

87. Saline hydrides are: **[4]**

i. strong oxidants
ii. strong reductants
iii. strong dehydrating agents
iv. strong bleaching age

a) iv and i

b) i and ii

c) iii and iv

d) only ii

88. Select the correct statement(s). **[4]**

a) $AlCl_3.6H_2O$ exists as $[Al(H_2O)_6]Cl_3$

b) With moist air, anhydrous $AlCl_3$ produces HCl gas

c) All of these

d) When Al is treated with aqueous caustic soda, hydrogen gas is liberated.

89. Atomic number of 15, 33, 51 represents the following family: **[4]**

a) Helium family

b) nitrogen family

c) oxygen family

d) carbon family

90. In an atom no two electrons can have the same value for all the quantum numbers. This was proposed by: **[4]**

a) Dalton

b) Pauli

c) Hund

d) Avogadro

91. The incorrect statement among the following is **[4]**

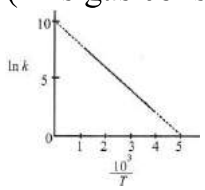
a) C_{60} is an allotropic form of carbon

b) S_8 is only allotropic form of sulphur

c) O_3 is an allotropic form of oxygen

d) Red phosphorus is more stable in air than white phosphorus

92. The rate constant (k) of a reaction is measured at different temperatures (T), and the data are plotted in the given figure. The activation energy of the reaction in kJ mol^{-1} is: (R is gas constant) **[4]**



a) 2R

b) R

c) $\frac{2}{R}$

d) $\frac{1}{R}$

93. A hydrogen electrode placed in a buffer solution of CH_3COONa and acetic acid in the ratio's x : y and y : x has electrode potential values volts E_1 and E_2 volts respectively at 25^oC. The pK_a values of acetic acid is: (E_1 and E_2 are oxidation potential) **[4]**

a) $\frac{E_1 - E_2}{0.118}$

b) $\frac{E_1 + E_2}{0.118}$

c) $\frac{E_2 - E_1}{0.118}$

d) $-\frac{E_1 + E_2}{0.118}$

94. Which one is correct about a hypothetical electrochemical cell shown below. **[4]**

$\ominus$ $\oplus$

$A \mid A^+(XM) \parallel B^+(YM) \mid B$

$E_{cell} = +0.20V$

a) $A^+ + B \longrightarrow A + B^+$

b) $A + B^+ \longrightarrow A^+ + B$

c) $A^+ + e \longrightarrow A$; $B^+ + e \longrightarrow B$

d) The cell reaction cannot be predicted

95. The rate constant K_1 of a reaction is found to be double that of rate constant K_2 of another reaction. The relationship between corresponding activation energies of the two reactions at same temperature (E_1 and E_2) can be represented as: **[4]**

a) $E_1 \neq E_2$

b) $E_1 = E_2$

c) $E_1 > E_2$

d) $E_1 < E_2$

96. Which of the following metal carbonates produce the corresponding metal on strong heating? **[4]**

a) Li_2CO_3

b) Ag_2CO_3

c) $SrCO_3$

d) $FeCO_3$

97. Heating oxalic acid with concentrated H_2SO_4 produces _____. **[4]**

a) $HCOOH + CO + H_2O$

b) $CO + CO_2 + H_2O$

c) $CO_2 + S + H_2O$

d) $SO_3 + H_2O$

98. Strong reducing and oxidising agents among the following, respectively, are **[4]**

a) Ce^{3+} and Ce^{4+}

b) Eu^{2+} and Ce^{4+}

c) Ce^{4+} and Tb^{4+}

d) Ce^{4+} and u^{2+}

99. Which among the following is a paramagnetic complex? (At. no. Mo = 42, Pt = 78) **[4]**

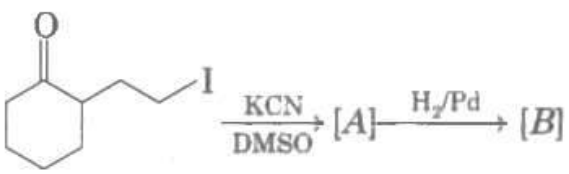
a) $[CoBr_4]^{2-}$

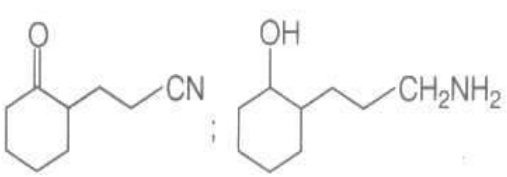
b) $Mo(CO)_6$

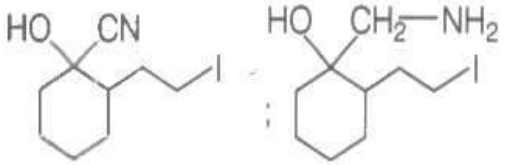
c) $[Co(NH_3)_6]^{3+}$

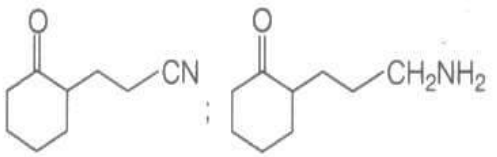
d) $[Pt(en)Cl_2]$

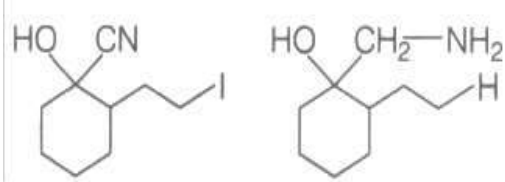
100. The major products A and B for the following reactions are, respectively **[4]**



a) 

b) 

c) 

d) 

BOTANY (Section-A)

101. Taxonomic keys are one of the Taxonomic tools in the identification and classification of plants and animals . it is used in the preparation of: **[4]**

a) Fauna

b) Both Monographs and Flora

c) Monographs

d) Flora

102. Two plants can be conclusively said to belong to the same species if they **[4]**

a) have more than 90 percent similar genes.

b) have same number of chromosomes.

c) look similar and possess identical secondary metabolites.

d) can reproduce freely with each other and form seeds.

103. The common members of basidiomycetes are: **[4]**

a) Albugo, Rhizopus and Mucor

b) Agaricus, Ustilago and Puccinia

c) Agaricus, Rhizopus and Alternaria

d) Alternaria, Colletotrichum and Trichoderma

104. Aristotle classified animals into: **[4]**

a) Animal with white blood and without red blood

b) All of these

c) Animal with red blood and without red blood

d) Animal with white blood and without white blood

105. Which one of the following statements is correct? **[4]**

a) Endothecium produces the microspores

b) Sporogenous tissue is haploid

c) Tapetum nourishes the developing pollen

d) Hard outer layer of pollen is called intine

106. Which one of the following belongs to vascular cryptogams? **[4]**

a) All of these

b) Gymnosperms

c) Angiosperm

d) Pteridophyta

107. What is the methods of vegetative reproduction in Spirogyra? **[4]**

a) All of these

b) Zoospores

c) Fragmentation

d) Fission

108. Perisperm is: **[4]**

a) Degenerate part of synergids

b) Part of secondary seed

c) Part of endosperm

d) Remnant of nucellus

109. Feathery stigma is present in: **[4]**

a) Mango

b) All of these

c) Pea

d) Wheat

110. The tissue which attaches the ovules inside the ovary is: **[4]**

a) Placenta

b) Hilum

c) Chalaza

d) Funicle

111. A vascular bundle with centripetal xylem is called: **[4]**

a) Mesarch

b) Exarch

c) Endarch

d) Mayarch

112. Sieve tubes are suited for translocation of food because they possess **[4]**

a) no end wall

b) broader lumen and perforated cross walls

c) no protoplasm

d) bordered pits

113. Among the following characters, which one was not considered by Mendel in his experiments on pea? **[4]**

a) Seed - Green or Yellow

b) Pod - Inflated or Constricted

c) Trichomes - Glandular or non-glandular

d) Stem - Tall or Dwarf

114. Edward's syndrome, Patau's syndrome and Down's syndrome are due to: **[4]**

a) Change in both sex chromosomes and autosomes

b) Change in autosomes

c) Mutation due to malnutrition

d) Change in sex chromosomes

115. What cellular structures or mechanisms facilitate the targeting and trafficking of proteins to the endoplasmic reticulum (ER)? **[4]**

a) Microfilaments

b) Motor proteins

c) Golgi apparatus

d) Peroxisomes

116. Total number of types of nucleotides usually formed in plants: **[4]**

a) Five

b) Eight

c) Ten

d) Four

117. Which of the following statement are not true? **[4]**

i. Prokaryotic cells are generally smaller and multiply more rapidly than the eukaryotic cells.

ii. Genomic DNA of bacteria is many chromosome/circular DNA.

iii. Many bacteria have small circular DNA outside the genomic DNA called plasmids.

iv. Plasmid DNA is used to monitor bacterial transformation with foreign DNA.

v. Mesosome is the characteristic of eukaryotes.

vi. Bacteria can be classified into two groups Gram-positive and Gram-negative.

a) (ii), (iv), (v)

b) (i), (ii), (iii)

c) (i), (iii)

d) (ii), (v)

118. Mitochondria and chloroplast are: **[4]**

A. semi-autonomous organelles,

B. formed by the division of pre-existing organelles and they contain DNA but lack protein-synthesizing machinery.

Which one of the following options is correct?

a) Both (A) and (B) are false

b) Both (A) and (B) are correct

c) (A) is true but (B) is false

d) (B) is true but (A) is false

119. Grafted kidney may be rejected in a patient due to: **[4]**

a) Cell-mediated immune response

b) Innate immune response

c) Passive immune response

d) Humoral immune response

120. Which of the following option contains only narcotics drugs? **[4]**

a) Morphine, codeine, heroine

b) Codeine, heroine, marijuana

c) Morphine, barbiturates, caffeine

d) Cocaine, caffeine, codeine

121. The correct sequence in cell cycle is **[4]**

a) G_1 - S - G_2 - M

b) M - G_1 - G_2 - S

c) G_1 - G_2 - S - M

d) S - G_1 - G_2 - M

122. Which of the following statements are correct? **[4]**

i. All birds and mammals and a very few lower vertebrate and invertebrate species are thermoregulation and osmoregulation.

ii. Majority (99 percent) of animals and nearly all plants cannot maintain a constant internal environment.

iii. Heat loss or heat gain is a function of surface area.

iv. During the course of evolution, the costs and benefits of maintaining a constant internal environment are taken into consideration.

v. Every summer the Keoladeo National Park (Bharatpur) in Rajasthan hosts thousands of migratory birds coming from Siberia and other extremely cold northern regions.

vi. Bears going into aestivation during winter and some snails and fish go into hibernation is an example of suspend.

vii. Under favourable conditions, many zooplankton species in lakes and ponds are known to enter diapause.

a) (i), (ii) and (iii) only

b) (i), (iii), (v) and (vi)

c) (v), (vi) and (vii)

d) (i), (ii), (iii) and (iv)

123. The model that shows how energy passes from one (a) zonation. (b) pyramid. trophic level to another trophic level is called **[4]**

a) photosynthesis.

b) an energy links.

c) a food chains.

d) a phytoplankton cycles.

124. Which one of the following pairs is not correctly matched? **[4]**

a) Streptomyces - Antibiotic

b) Serratia - Drug addiction

c) Rhizobium - Biofertilizer

d) Spirulina - Single cell protein

125. Consider the following statements (A-D) each with one or two blanks. **[4]**

A. Bears go into (1) during winter to (2) cold weather.

B. A conical age pyramid with a broad base represents (3) human population.

C. A wasp pollinating a fig flower is an: example of (4).

D. An area with high levels of species richness is know nasa (5).

Which one of the following options, gives the correct fillups for the respective blank numbers from (I) to (5) in the statements?

a) (3) - stable (4) - commensalism, (5) marsh

b) (3) - expanding, (4) - commensalism, (5) - biodiversity park

c) (1) - hibernation, (2) - escape, (3) - expanding (5) - hot spot

d) (1) - aestivation, (2) - escape, (3) - stable, (4) - mutualism

126. Animal which get extincted in last few years? **[4]**

a) Hyena

b) Golden langoor

c) Cheetah

d) Blue cow

127. In the tropical rainforest, the majority of trees have showy animal-pollinated flowers. Intemperate forests the majority of trees are wind pollinated. **[4]**

Which factors best explain these contrasting patterns?

i. Wind is rare in tropical forests.

ii. Because of high species diversity in the tropics, individuals of tree species are often widely separated making wind an inefficient means of pollen dispersal.

iii. More opportunities for coevolved mutualisms exist in tropical forests because of the high diversity of animal species.

iv. Trees in tropical forests are mostly evergreen and year-round leaf canopies impede pollen dispersal by wind.

v. Flowering in tropical forests occurs over a short period of time when wind is absent.

a) (i), (ii) and (v)

b) (ii) and (iv)

c) (ii), (iii) and (iv)

d) (i), (iii) and (v)

128. Centromere is required for: **[4]**

a) Chromosome segregation

b) Replications of DNA

c) Pole ward movement of chromosomes

d) Cytoplasmic cleavage

129. Mitotic spindle attached with kinetochore of centromere is: **[4]**

a) End of metaphase

b) Starting of metaphase

c) Starting of prophase

d) End of prophase

130. Which of the following is the correct match? **[4]**

Options		
(A)	Stroma	Photolysis of water
(B)	Thylakoid	Carbon dioxide fixation
(C)	Appressed part of thylakoids	PS II
(D)	Stroma lamellae	PS I and PS II

a) Option (d) is correct.

b) Option (b) is correct.

c) Option (c) is correct.

d) Option (a) is correct.

131. Match the columns: **[4]**

Column I	**Column II**
(A) Chlorophyll-a	(i) Yellow
(B) Chlorophyll-b	(ii) Yellow to yellow-orange
(C) Xanthophylls	(iii) Bright or blue green
(D) Carotenoids	(iv) Yellow green

a) (A) - (ii), (B) - (iv), (C) - (iii), (D) - (i)

b) (A) - (i), (B) - (ii), (C) - (iii), (D) - (iv)

c) (A) - (iii), (B) - (iv), (C) - (i), (D) - (ii)

d) (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)

132. Which of the following statements is true regarding chemiosmotic hypothesis? **[4]**

i. Protons or hydrogen ions that are produced by the splitting of water accumulate within the lumen of the thylakoids

ii. Primary accepter of electron which is located towards the outer side of the thylakoids membrane transfers its electron not to an electron carrier but to an H carrier

iii. The NADP reductase enzyme is located on the stroma side of the membrane

iv. Protons are also removed from the stroma by NADP

v. Due to removal of proton by NADP, within the chloroplast, protons in the stroma decrease in number, while in the lumen there is accumulation of protons. This creates a proton gradient across the thylakoid membrane

vi. Due to accumulation of protons in lumen of thylakoid measurable increase in pH in the lumen

a) (i), (ii), (iii), (iv) and (v)
b) (i), (ii), (iii) and (v)
c) Only (iv) and (vi)
d) (i), (ii), (iv) and (vi)

133. The factor which is not an external factor for photosynthesis is: **[4]**

a) chlorophyll
b) light
c) CO_2
d) H_2O

134. In which of the following steps of Glycolysis a water molecule is released? **[4]**

a) 2-Phosphoenol pyruvate $\longrightarrow$ Pyruvic acid
b) 2-Phosphoglycerate $\longrightarrow$ Phosphoenol pyruvate
c) Fructose-6-phosphate $\longrightarrow$ Fructose 1, 6-diphosphate
d) 2-Phosphoglycerate $\longrightarrow$ Phosphoenol pyruvate

135. One of the preventive methods of fruit drop is by spraying: **[4]**

a) Auxin
b) Gibberellins
c) Cytokinin
d) Ethylene gas

BOTANY (Section-B)

Attempt any 10 questions

136. Man is placed in which Phylum? **[4]**

a) Mammalia
b) Primata
c) Chordata
d) Hominidae

137. Taxonomy which is based on all observable characteristics and each character is given equal importance is: **[4]**

a) Natural classification system
b) Numerical taxonomy
c) Cytotaxonomy
d) Phylogenetic classification

138. Which of the following is not correct for green algae? **[4]**

a) Asexual reproduction by flagellated zoospores produced in zoosporangia

b) Vegetative reproduction usually takes place by fragmentation

c) Chlamydomonas, Volvox, Ulothrix, Spirogyra and Chara are green algae

d) The sexual reproduction only oogamous

139. The true embryo develops as a result of fusion of **[4]**

a) a synergid and a male gamete.

b) two polar nuclei of embryo sac.

c) an egg cell and a male gamete.

d) a male gamete and antipodals.

140. Match the Column I with Column II: **[4]**

Column I	Column II
(A) 	(i) Axile
(B) 	(ii) Marginal
(C) 	(iii) Parietal
(D) 	(iv) Free Central
(E) 	(v) Basal

a) (A) - (v), (B) - (ii), (C) - (iv), (D) - (iii), (E) - (i)

b) (A) - (iii), (B) - (i), (C) - (iv), (D) - (v), (E) - (ii)

c) (A) - (ii), (B) - (iv), (C) - (v), (D) - (iii), (E) - (i)

d) (A) - (iii), (B) - (i), (C) - (iv), (D) - (ii), (E) - (v)

141. Drosophila melanogaster has: **[4]**

a) 3 pairs of autosomes and 1 pair of sex chromosomes

b) 1 pair of autosomes and 3 pairs of sex chromosomes

c) 3 pairs of autosomes and 3 pairs of sex chromosomes

d) 2 pairs of autosomes and 1 pair of sex chromosomes

142. The DNA molecule is composed of: **[4]**

a) Pentose sugar, Phosphoric acid, Pyrimidines and Purines

b) Pentose sugar, Pyrimidines and Purines only

c) Pentose sugar, Phosphoric arid and Pyrimidines only

d) Pentose sugar, Phosphoric acid and Purines only

143. Three of the following statements regarding cell organelles are correct while one is wrong. Which one is wrong? **[4]**

a) Lysosomes are double membraned vesicles budded off from Golgi apparatus and contain digestive enzymes.

b) Leucoplasts are bound by two membranes, lack pigment but contain their own DNA and protein synthesizing machinery.

c) Endoplasmic reticulum consists of a network of membranous tubules and helps in transport, synthesis and secretion.

d) Sphaerosomes are single membrane bound and are associated with synthesis and storage of lipids.

144. A good producer of citric acid is: **[4]**

a) Aspergillus

b) Pseudomonas

c) Saccharomyces

d) Pseudomonas

145. Which statement is wrong for Kreb's cycle? **[4]**

a) There is one point in the cycle where FAD^{+} is reduced to $FADH_2$

b) During conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised

c) The cycle starts with the condensation of acetyl group (Acetyl CoA) with pyruvic acid to yield citric acid

d) There are three points in the cycle where NAD^+ is reduced to $NADH + H^+$

146. The domestic sewage in large cities: **[4]**

a) When treated in STPs does not really require the aeration step as the sewage contains adequate oxygen

b) Has a high BOD as it contains both aerobic and anaerobic bacteria

c) Has very high amounts of suspended solids and dissolved salts

d) Processed by aerobic and then anaerobic bacteria in the secondary treatment in Sewage Treatment Plant (STPs)

147. Which of the following one is correct for a food chain? **[4]**

A. Grass-Grasshopper-Frog-Snake-Hawk

B. Grasshopper-Grass-Snake-Frog-Hawk

C. Hawk-Grasshopper-Grass-Frog-Snake

D. Frog-Snake-Hawk-Grasshopper-Grass

a) C

b) A

c) D

d) B

148. Bakanae disease in the rice plants (paddy) is caused by: **[4]**

a) Indole acetic acid (IAA)

b) Gibberellic acid (GA)

c) 2, 4-Dichlorophenoxyacetic acid (2, 4-D)

d) Naphthalene acetic acid (NAA)

149. Abscisic acid treatment results in: **[4]**

a) Root elongation

b) Stomatal closure

c) Leaf expansion

d) Stem elongation

150. With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct? **[4]**

a) C_3 plants responds to higher temperature with enhanced photosynthesis while C_4 plants

b) Increasing atmospheric CO_2 concentration upto 0.05% can enhance CO_2 fixation rate

have much lower temperature optimum

c) Light saturation for CO_2 fixation occurs at 10% of full sunlight

d) Tomato is a green house crop which can be grown in CO_2 enriched atmosphere for higher yield

ZOOLOGY (Section-A)

151. Not associated with sponge: **[4]**

a) Archeocytes

b) Myocytes

c) None of these

d) Choanocytes

152. Alternation of generation in which both polyp and medusa stage is present is called: **[4]**

a) Metamorphosis

b) All of these

c) Metagenesis

d) Metamerism

153. Which of the following pairs are correctly matched? **[4]**

Animals	**Morphological features**
(A) Crocodile	4-chambered heart
(B) Sea urchin	Parapodia
(C) Obelia	Metagenesis
(D) Lemur	Thecodont

a) Only A and B

b) A, C and D

c) Only A and D

d) B, C and D

154. Which one of the following is the correct pairing of a body part and muscle fibre that moves it? **[4]**

a) Iris - involuntary smooth muscle

b) Heart wall - involuntary unstriated muscle

c) Abdominal wall - smooth muscle

d) Biceps of upper arm - smooth muscle fibres

155. Peyer's patches are found in: **[4]**

a) Trypsin

b) Lymphocytes

c) Mucosa

d) Enterokinase

156. The volume of air involved in breathing movements can be estimated by using a spirometer which helps in clinical assessment of pulmonary functions. Match the entities in Column I with their character in Column II regarding volume of air. **[4]**

Column I	Column II
(A) Total lung capacity	(i) 1100 mLto 1200 mL
(B) Vital capacity	(ii) 500 mL
(C) Residual volume	(iii) 4800 mL to 5000 mL
(D) Expiratory reserve volume	(iv) 6000 mL to 8000 mL
(E) Inspiratory reserve volume	(v) 1000 mL to 1100 mL
(F) Tidal volume	(vi) 2500 mL to 3000 mL

a) (A)-(iv), (B)-(iii), (C)-(v), (D)-(iii), (E)-(i), (F)-(ii)

b) (A)-(v), (B)-(iv), (C)-(iii), (D)-(ii), (E)-(i), (F)-(vi)

c) (A)-(i), (B)-(v), (C)-(vi), (D)-(iv), (E)-(ii), (F)-(iii)

d) (A)-(iv), (B)-(iii), (C)-(i), (D)-(v), (E)-(vi), (F)-(ii)

157. What would happen if human blood becomes acidic (low pH)? **[4]**

a) RBCs count decreases

b) Oxygen carrying capacity of haemoglobin increases

c) RBCs count increases

d) Oxygen carrying capacity of haemoglobin decreases

158. Blood does not become acidic although it carries CO_2 beacause **[4]**

a) in CO_2 transport, buffers play an important role.

b) CO_2 is continuously diffused through tissues.

c) CO_2 is absorbed by WBC.

d) CO_2 combines with H_2O to form $H2CO_3$.

159. Which one has the lowest value? **[4]**

a) Tidal volume

b) Inspiratory reserve volume

c) Expiratory reserve volume

d) Vital capacity

160. Which one of the following statements is incorrect? **[4]**

a. The principle of counter-current flow facilitates efficient respiration in gills of fishes.

b. The residual air in lungs slightly decreases the efficiency of respiration in mammals.

c. The presence of non-respiratory air sacs increases the efficiency of respiration in birds.

d. In insects, circulating body fluids serve to distribute oxygen to tissues.

a) Statement (a) is incorrect.

b) Statement (b) is incorrect.

c) Statement (d) is incorrect.

d) Statement (c) is incorrect.

161. Term **puberty** means: **[4]**

a) Beginning of ovulation

b) Complete maturation of animal

c) Appearance of secondary sexual characters

d) Appearance of primary sexual characters

162. Given statements represent different phenomena of menstrual cycle: **[4]**

A. Menstrual flow lasts for 3-5 days.

B. Changes in the ovary and the uterus are induced by changes in the levels of pituitary and ovarian hormones.

C. The secretion of gonadotropins (LH and FSH) increases gradually and stimulates secretion of estrogens by the growing follicles.

D. Both LH and FSH attain a peak level in the middle of cycle (about 14th day).

E. The corpus luteum secretes large amounts of progesterone.

Choose correct option for follicular phase.

a) (B), (C), (D) and (E)

b) (B), (C) and (D)

c) (D) and (E)

d) (A) and (E) only

163. Match column I with column II and select the correct option from the codes given below. **[4]**

Column - I	**Column - II**
(A) Corpus luteum	(i) Morphogenetic movements
(B) Gastrulation	(ii) Progesterone
(C) Colostrum	(iv) Sperm activation
(D) Capacitation	(v) Mammary gland

a) A - (ii), B - (iv), C - (iii), D - (i)

b) A - (ii), B - (i), C - (iv), D - (iii)

c) A - (iii), B - (i), C - (iv), D - (ii)

d) A - (ii), B - (iv), C - (i), D - (iii)

164. During which of the following weeks of intrauterine life the amniotic fluid is taken out with the help of a surgical needle and separation of the embryo cells present in this fluid is done for amniocentesis: **[4]**

a) 12 weeks
b) 15 weeks
c) 24 weeks
d) 5 weeks

165. Which factor is responsible for an explosive impact on the growth of the population? **[4]**

a) Decreased maternal mortality rates
b) Better detection and cure of STDs
c) Increased health facilities along with better living conditions
d) Better awareness about sex related matters

166. Cranial capacity of Java man was: **[4]**

a) 900 cc
b) 650 cc
c) 1450 cc
d) 400 cc

167. Which of the following statements are correct about the characteristics of protobionts, like microspheres as envisaged in the abiogenic origin of life? **[4]**

i. They were able to reproduce.
ii. They could separate the combinations of molecules from the surroundings.
iii. They were partially isolated from the surroundings.
iv. They could maintain an internal environment absolutely.

a) (iii) and (iv)
b) (i) and (ii)
c) (ii) and (iii)
d) (i), (ii), (iii), and (iv)

168. Which one of the four parts mentioned below does not a part of a uriniferous tubule? **[4]**

a) Collecting duct
b) Bowman's capsule
c) Loop of Henle
d) Proximal convoluted tubule

169. Blood vessels, nerves, and ureter enter the kidney at a point called: **[4]**

a) Hilus
b) Renal cortex
c) Renal pyramid
d) Renal medulla

170. Human kidney measures: **[4]**

a) 2cm × 4cm × 5cm

b) 10cm × 5cm × 3cm

c) 5cm × 10cm × 25cm

d) 15cm × 10cm × 20cm

171. Myoglobin is found in: **[4]**

a) Blood

b) Liver

c) Muscles

d) Spleen

172. Red muscles have abundant: **[4]**

a) Lactic acid and acetic acid

b) Relaxin and myosin

c) Myoglobin and cytochrome

d) Glucose and haemoglobin

173. Wish bone in birds is formed from the bones of: **[4]**

a) Keeled sternum

b) Shoulder girdle

c) Skull bones

d) Hip girdle

174. Learning is related to which part of the human brain? **[4]**

a) Medulla oblongata

b) Hypothalamus

c) Cerebellum

d) Cerebrum

175. Which cranial nerve has the highest number of branches? **[4]**

a) Trigeminal nerve

b) Facial nerve

c) Vagus nerve

d) Optic nerve

176. Complete the statement by choosing appropriate match among the following - **[4]**

Column-I	Column-II
(A) Resting potential	(i) Chemicals involved in the transmission of impulses at synapses.
(B) Nerve impulse	(ii) Gap between the pre-synaptic and post-synaptic neurons.
(C) Synaptic left	(iii) Electrical potential difference across the resting neural membrane.
(D) Neurotransmitters	(iv) An electrical wave like response of a neuron to a stimulation.

a) (A)-(iv), (B)-(v), (C)-(ii), (D)-(i)

b) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)

c) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)
d) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)

177. Which of the following hormones can play a significant role in osteoporosis? **[4]**

a) Estrogen and parathyroid hormone
b) Progesterone and aldosterone
c) Parathyroid hormone and prolactin
d) Aldosterone and prolactin

178. Disease caused by deficiency of iodine is: **[4]**

a) Cretinism
b) Alkalosis
c) Goitre
d) Tetany

179. If nerves of heart are cut, then heart will: **[4]**

a) beat arrhythmically
b) shrink
c) stop
d) beat rhythmically

180. Normally how many times does the heart of humans beat per minute? **[4]**

a) 60
b) 120
c) 72
d) 80

181. Urea is transported by **[4]**

a) WBC
b) RBC
c) Blood plasma
d) Platelets

182. Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme? **[4]**

a) 5'-CGTTCG-3'
3'-ATGGTA-5'
b) 5'-GATATQ-3'
3'-CTACTA-5'
c) 5'-GAATTC-3'
3'-CTTAAG-5'
d) 5'-CACGTA-3'
3'-CTCAGT-5'

183. The method of multiplication of antibiotics resistance gene through E.coli is called : **[4]**

a) Transcription of antibiotic resistance gene
b) Transformation of antibiotic resistance gene

c) Cloning of antibiotic resistance gene

d) Replication of antibiotic resistance gene

184. Transgenic animals that serve as model to study many human diseases such as: **[4]**

a) night-blindness

b) Alzheimer's

c) Both Alzheimer's and cancer

d) cancer

185. Important objective of biotechnology in agriculture section is : **[4]**

a) To increase the plant weight

b) To produce pest resistant varieties of plant

c) To increase the nitrogen content

d) To decrease the seed number

ZOOLOGY (Section-B)

Attempt any 10 questions

186. The subphylum of chordata in which notochord is found through out in the length: **[4]**

a) Urochordata

b) Hemichordata

c) Cephalochordata

d) Botryllus

187. While doing work and running, you move your organs like hands and legs, etc. Which among the following is correct? **[4]**

a) Skeletal muscles contract and pull the ligament to move the bones.

b) Smooth muscles contract and pull the tendons to move the bones.

c) Smooth muscles contract and pull the ligament to move the bones.

d) Skeletal muscles contract and pull the tendon to move the bones.

188. Which one of the following does not have an open circulatory system? **[4]**

a) Cockroach

b) Chelone

c) Both chelone and Frog's tadpole

d) Frog's tadpole

189. The covering of the lung is called: **[4]**

a) Pericardium

b) Peritoneum

c) Pleural membrane

d) Capsule

190. Which layer develops first during embryonic development of man? **[4]**

a) Ectoderm
b) Endoderm
c) Mesoderm
d) Both Ectoderm and Mesoderm

191. If for some reason, the vasa efferentia in the human reproductive system get blocked, the gametes will not be transported from: **[4]**

a) Epididymis to vas deferens
b) Vagina to uterus
c) Testes to epididymis
d) Ovary to uterus

192. In forming the theory of evolution by natural selection Darwin was greatly influenced by: **[4]**

a) Lamarck acquired characters
b) Mutations of Hugo de Vries
c) Malthus idea of population control
d) Environmental factors

193. Which of the following statements is not correct with respect to human kidney? **[4]**

a) The concave part of kidney is called hilus.
b) The peripheral region is called cortex and central medulla.
c) Blood enters glomerulus through efferent arterioles.
d) Malpighian capsules are present in the cortex region.

194. In man the axial skeleton is made up of: **[4]**

a) 103 bones
b) 80 bones
c) 100 bones
d) 106 bones

195. The sensory receptors that respond to sound, develop receptor potentials when their **[4]**

a) pigments absorb pressure.
b) surface proteins are altered by a change in pH.
c) hairs are bent.
d) sodium-potassium pumps become deactivated.

196. When the B.R is high and over loading of heart is present then which hormone is released for compensating this mechanism? **[4]**

a) Renin
b) Atri-natriuretic factor
c) ADH
d) Aldosterone

197. Match the following columns and select the correct option: **[4]**

Column-I	Column-II
(A) Pituitary hormone	(i) Steroid
(B) Epinephrine	(ii) Neuropeptides
(C) Endophins	(iii) Peptides, proteins
(D) Cortisol	(iv) Biogenic amines

a) (A) - (iv), (B) - (iii), (C) - (i), (D) - (ii)

b) (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)

c) (A) - (iii), (B) - (iv), (C) - (i), (D) - (ii)

d) (A) - (iv), (B) - (i), (C) - (ii), (D) - (iii)

198. Which of the following statement is true for cardiac arrest? **[4]**

A. State of heart when it is not pumping blood effectively enough to meet the needs of the body

B. Sometimes called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease

C. Heart stops beating

a) Only A

b) Only B

c) Only C

d) All of these

199. Which of the following statement is incorrect? **[4]**

i. The name EcoRl comes from Escherichia coli-13.

ii. Restriction endonucleases are used in genetic engineering to form recombinant molecules of DNA.

iii. HindIl always cuts DNA molecules at a particular point by recognising a specific sequence of 4 base pairs.

iv. Besides HindII, today we know more than 900 restriction enzymes.

a) Statement (iii) is incorrect.

b) Statement (ii) is incorrect.

c) Statement (i) is incorrect.

d) Statement (iv) is incorrect.

200. Transgenic crops are modified through genetic engineering to develop natural resistance to insect pests. Which one is a transgenic plant? **[4]**

a) Tomato and Parthenium

b) Tomato and Goat grass

c) Tobacco and cotton

d) Maize and sugarcane

Solution

SAMPLE PAPER - 7

PHYSICS (Section-A)

1.

(c) $[M^1L^2T^{-2}]$

Explanation: $[M^1L^2T^{-2}]$

2. **(a)** $M^{-1}L^{-3}T^3I^2$

Explanation: $\sigma = \frac{ne^2\tau}{m}$

$[\sigma] = \frac{L^{-3}I^2T^2T}{M} = M^{-1}L^{-3}T^3I^2$

3.

(b) non-uniform acceleration

Explanation: Curved lines in velocity-time graph for a particle in a given interval of time implies non-uniform acceleration.

4. **(a)** changes in direction

Explanation: Because the particle moving in a circle describes equal angles in equal times, hence both ω and r are constant. Thus, magnitude of velocity vector remains constant but the direction changes from point to point.

5.

(c) 3.5

Explanation: The equation of trajectory is $y = x \tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$

where θ is the angle of projection and u is the velocity with which projectile is projected.

For equal trajectories for same angles of projection, $\frac{g}{u^2}$ = constant

As per the question, $\frac{9.8}{5^2} = \frac{g'}{3^2}$

where g' is the acceleration due to gravity on the planet.

$g' = \frac{9.8 \times 9}{25} = 3.5\ ms^{-2}$

6.

(c) 4 N

Explanation: When the elevator is descending a pseudo force acts on it in the upword direction

∴ from free body diagram

m = 0.5

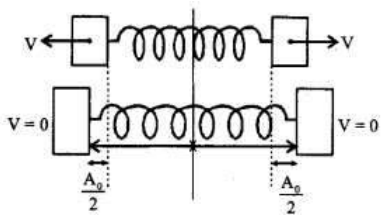
g = 10
a = 2
mg - N = ma
N = m(g - a)
= 0.5(10 - 2) = 4 N
so the force exerted by the block A m the block B in 4N.

7.

(b) $\frac{v}{2}$

Explanation: Given, spring constant of spring, K = $2Nm^{-1}$

Mass of block, m = 250g = $\frac{250}{1000}$ g = $\frac{1}{4}$ kg



Using energy conservation

$\frac{1}{2}mv^2 \times 2 = \frac{1}{2}kx^2 \Rightarrow \frac{1}{4}v^2 = \frac{1}{2} \times 2 \times x^2 \ \therefore x = \frac{v}{2}$

8.

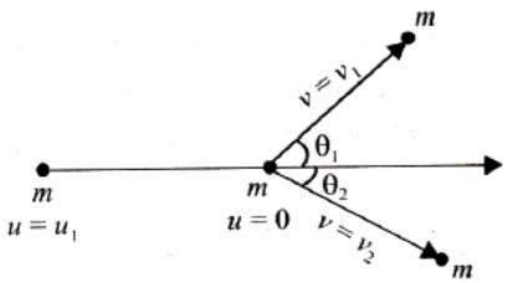
(d) $\theta = 90°$

Explanation:

Since the given collision is elastic so we can use both, the principles of conservation of linear momentum and conservation of kinetic energy.

And as the mass of the two bodies are equal and considering one body to be initially at rest, we have

$u_1 = v_1\cos\theta_1 + v_2\cos\theta_2$ ...(i)



$v_1\sin\theta_1 = v_2\theta_2$

$\Rightarrow$ $v_1\sin\theta_1 - v_2\theta_2$ (ii)

also $u_1^2 = v_1^2 + v_2^2$ ...(iii)

Squaring and adding (i) and (ii), we have

$v_1^2 + v_2^2 + 2v_1v_2(\cos\theta_1\cos\theta_2 - \sin\theta_1\sin\theta_2) = u_1^2$

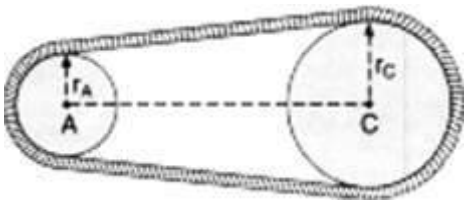
$\Rightarrow$ $\cos(\theta_1 + \theta_2) = 0$ [using (iii)]

$\Rightarrow \cos\theta = 0$ where $\theta = \theta_1 + \theta_2$

$\Rightarrow \theta = 90^o$

9. **(a)** 3

Explanation:



As the belt does not slip,

vA = vC

i.e., $r_A\omega_A = r_C\omega_C \quad (arv = r\omega)$ ...(i)

According to problem. r_A = r and r_C = 3r

So, eq. (i) becomes,

$\omega_A = 3\omega_C$

If both the wheels have same angular momentum

$I_A\omega_A = I_C\omega_C$

$\therefore \quad \frac{I_C}{I_A} = \frac{\omega_A}{\omega_C} = 3$

10. **(a)** 2 s

Explanation: Rotation kinetic energy of a body is given by $KE_{rotational} = \frac{1}{2}I\omega^2$

where, $\omega = \omega_0 + \alpha t$

So, $KE_{rotational} = \frac{1}{2}I\left(\omega_0 + \alpha t\right)^2$ ...(i)

Here, I = 1.5 kgm^2,

KE = 1200 J and α = 20 rad/s^2 and $\omega_0 = 0$

Substituting these values in Eq. (i), we get

$1200 = \frac{1}{2}(1.5)(20 \times t)^2$

$\Rightarrow \quad t^2 = \frac{2 \times 1200}{15 \times 400} = 4$

$\therefore$ t = 2s

11. **(d)** $\frac{1}{\sqrt{2}}$

Explanation: Escape velocity of the body from the surface of the earth is:

$v = \sqrt{2gR}$

Escape velocity of the body from the platform:

Potential Energy + Kinetic Energy = 0

$$-\frac{GMm}{2R}+\frac{1}{2}mv^2=0$$

$$f_{v_{escape}}=\sqrt{\frac{GM}{R^2}}R=\sqrt{gR}$$

From the surface of earth, $v_{escape}=\sqrt{2gR}$

$$\therefore \quad fv_{escape}=\frac{v_{escape}}{\sqrt{2}}$$

or $f=\frac{1}{\sqrt{2}}$

12.

(c) Only (a)

Explanation: Basic reason of elasticity is interatomic force and strain energy in material of a body is stored in the form of interatomic energy.

13.

(d) 112

Explanation: Rate of heat radiated at (227 + 273) K = 7 cal/(cm^2)

Rate of heat radiated at (727 + 273) K = x

By Stefan's law, $7 \propto (500)^4$

$x \propto (1000)^4$

$$\therefore \quad \frac{x}{7}=2^4$$

or $x = 7 \times 2^4 = 112$ cal/(cm^2)

14.

(c) only ii

Explanation: With the rise in temperature, the amplitude of vibration and hence the energy of atoms increases. This results in an increase in the average distance between them and the rod expand.

15. **(a)** 4 PV

Explanation: Work done = Area of curve enclosed

= 2V × 2P

= 4PV

16.

(d) 499m/s

Explanation: $v_{rms}=\sqrt{\frac{3\rho v}{\text{mass of the gas}}}$

17.

(d) $\frac{T}{2}$

Explanation: As we know that,

$$T \propto \frac{1}{\sqrt{k}}$$

$$\therefore \frac{T_2}{T_1} = \sqrt{\frac{k_1}{k_2}}$$

$$= \sqrt{\frac{k}{4k}}$$

$$= \frac{1}{2}$$

or, $T_2 = \frac{T_1}{2} = \frac{T}{2}$

18. **(a)** $v_2 = v_1 (V_2/V_1)$

Explanation: $v_2 = v_1 (V_2/V_1)$

19.

(c) $(\frac{4}{3})$

Explanation: Musical scale is ratio of frequencies

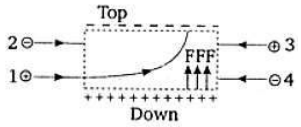
$$= \frac{320}{240} = \frac{4}{3}$$

20.

(b) Top, down, top, down

Explanation:

The figure shows the path of a +ve charged particle (1) through a rectangular region of the uniform electric field.



Since +ve charged particle moves as a parabolic path in the electric field, it means the direction of the electric field is upward. The direction of the deflection of the particle (2) which is - ve is downward. The direction of deflection of the particle (3) which is +ve is upward and the direction of deflection of the particle (4) is downward.

21.

(c) $4\mu F, 36\mu F$

Explanation: $4\mu F, 36\mu F$

22.

(c) $R = r_1 - r_2$

Explanation: $I = \frac{2E}{\eta_1 + r_2 + R}$

$V = E - Ir_1 = E - \left(\frac{2E}{\eta_1 + r_2 + R}\right) r_1$

$= E\left[\frac{r_1 + r_2 + R - 2r_1}{r_1 + r_2 + R}\right]$

But $V = 0$

Hence $r_2 + R - r_1 = 0$

or $R = (r_1 - r_2)$

23.

(c) Zero

Explanation: Rotation of loop by 30° about an axis perpendicular to its plane does not change the angle between the magnetic moment and magnetic field. Hence, no work is done.

24.

(b) $\frac{\sqrt{3}}{1}$

Explanation: A tangent galvanometer is an early measuring instrument for small electric currents. It consists of a coil of insulated copper wire wound on a circular non-magnetic frame. Its working is based on the principle of the tangent law of magnetism. When a current is passed through the circular coil, a magnetic field (B) is produced at the center of the coil in a direction perpendicular to the plane of the coil. The TG is arranged in such a way that the horizontal component of the earth's magnetic field (Bh) is in the direction of the plane of the coil. The magnetic needle is then under the action of two mutually perpendicular fields. If θ is the deflection of the needle, then according to tangent law,

$B = B_h \tan\theta$

where $B = \frac{\mu_o nI}{2a}$

Where n is number of coils, I is current and a is radius of coil.

Given radius of both coils are same.

The current will be same as both coils are connected in series

$B_1 = \frac{\mu_o n_1 I}{2a} = B_h \tan\theta$ ...(i)

$$B_2 = \frac{\mu_\circ n_2 I}{2a} = B_h \tan\theta_2 \ ...(ii)$$

$$\frac{B_1}{B_2} = \frac{\tan\theta_1}{\tan\theta_2}$$

$$\frac{n_1}{n_2} = \frac{\tan\theta_1}{\tan\theta_2}$$

$$\frac{n_1}{n_2} = \frac{\tan 60}{\tan 45}$$

$$\frac{n_1}{n_2} = \frac{\sqrt{3}}{1}$$

25. **(a)** 4 s

Explanation: The time period T of oscillation of a magnet is given by:

$$T = 2\pi\sqrt{\frac{I}{MB}}$$

where,

I = Moment of inertia of the magnet about the axis of rotation

M = Magnetic moment of the magnet

B = Uniform magnetic field

As the I, B remains the same

$$\therefore \quad T \propto \frac{1}{\sqrt{B}} \text{ or } \frac{T_2}{T_1} = \sqrt{\frac{B_1}{B_2}}$$

According to given problem,

$B_1 = 24\mu$

$B_2 = 24\mu T - 18\mu T = 6\mu T$, $T_1 = 2s$

$$\therefore \quad T_2 = (2s)\sqrt{\frac{(24\mu T)}{(6\mu T)}} = 4 \text{ s}$$

26. **(a)** both medium between the coils and separation between coils

Explanation: Mutual inductance of two coils is,

$$M = \frac{\mu_0 N_1 N_2 A}{l}$$

27.

(d) Bvl - IR

Explanation: The wire ab which is moving with a velocity v is equivalent to an emf source of value Bvl with its positive terminal towards a. Further, the equivalent emf has an internal resistance R.

∴ Potential difference

$V_a - V_b = Bvl - IR$

28. **(a)** 20 mA

Explanation: 20 mA

29.

(b) $\sqrt{\frac{1}{\mu_0 \varepsilon_0}}$

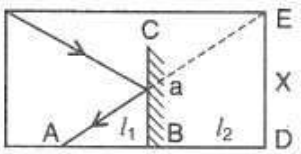
Explanation: $\sqrt{\frac{1}{\mu_0 \varepsilon_0}}$

30.

(b) 3 metres

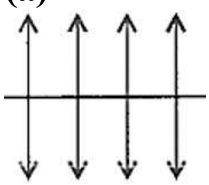
Explanation:

The image of the wall will be behind the mirror at a distance $l_2 = 4$ m. If the eye is placed at point A, it will see only the rays coming from all points in the section of the wall image DE after reflection in the mirror BC. Thus, the section of the wall visible in the minor will have dimensions:

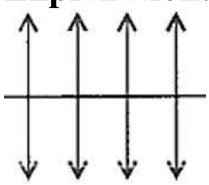


$$x = \frac{l_1 + l_2}{l_1} a = \frac{2 + 4}{2} \times 1 = 3 \text{ m}$$

31. **(a)**



Explanation:



32.

(c) Graph does not change

Explanation: According to Einstein's photoelectric equation

$K_{max} = h\nu - \phi_0$

$$\Rightarrow \quad eV_s = \frac{hc}{\lambda} - \phi_0$$

$\Rightarrow V_s = \frac{hc}{\lambda e} - \frac{\phi_0}{e}$ where λ = wavelength of incident light

ϕ_0 = work function

V_s = stopping potential

Comparing die above equation with y = mx + c, we get slope = $\frac{hc}{e}$

Increasing the frequency of incident radiation has no effect on work function and frequency. So, the graph will not change.

33.

(b) 620 nm

Explanation: Now, frequency $v_o = \frac{hc}{\lambda}$

$\lambda = \frac{hc}{v_0} = \frac{12400}{2} = 6200\ ^oA$

or = 6200 × 10^{-10} m = 620 nm

34.

(b) 3.4 eV

Explanation: Energy required, $E_n = \frac{13.6}{n^2}$ eV

$\therefore E_2 = \frac{13.6}{(2)^2} = 3.4$ eV

(In the Balmer series, the electron transition can be between second orbit and infinite orbit).

35. **(a)** $\frac{I_0}{9}$

Explanation: $\left(\frac{I}{I_0}\right) = \left(\frac{1}{2}\right)^{t/T}$ or $\frac{1}{3} = \left(\frac{1}{2}\right)^{9/T}$

or $\left(\frac{I'}{I_0}\right) = \left(\frac{1}{2}\right)^{18/T} = \left[\left(\frac{1}{2}\right)^{9/T}\right]^2 = \left(\frac{1}{3}\right)^2$

Hence, I' = $\frac{I_0}{9}$

PHYSICS (Section-B)

36.

(b) $\frac{1}{2}mgR$

Explanation: Gain in potential energy,

$$\Delta U = \frac{mgh}{1+\frac{h}{R}}$$

If h = R

Then, $\Delta U = \frac{mgR}{1+\frac{R}{R}}$

$= \frac{1}{2}mgR$

37.

(b) $\left(\frac{m_1-m_2}{m_1+m_2}\right)^2 g$

Explanation: Acceleration a_{cm} of the centre of mass of the system of m_1 and m_2 is given by:

$$a_{cm} = \frac{m_1a_1+m_2a_2}{m_1+m_2}$$

As m_1 moves downwards with acceleration a and m_2 moves upwards with acceleration a, hence numerically

$a_1 = +a$, $a_2 = -a$

$$a_{cm} = \frac{m_1(a)+m_2(-a)}{m_1+m_2} = \left(\frac{m_1-m_2}{m_1+m_2}\right)a$$

But $a = \left(\frac{m_1-m_2}{m_1+m_2}\right)g$

$$\therefore \quad a_{cm} = \left(\frac{m_1-m_2}{m_1+m_2}\right)\left(\frac{m_1-m_2}{m_1+m_2}\right)g = \left(\frac{m_1-m_2}{m_1+m_2}\right)^2 g$$

38.

(d) (ii) only

Explanation: Gravitational force is always attractive and a long-range force. It is independent of the presence of other bodies.

39.

(c) 2×10^{-5}

Explanation: From, $V_T = V_0(1 + \gamma\Delta T)$

$$\Rightarrow \frac{V_T - V_0}{V_0} = \gamma \Delta T$$

$$\frac{0.24}{100} = \gamma 40$$

$$\gamma = \frac{0.24}{100 \times 40} = 6 \times 10^{-5}\ {}^0C^{-1}$$

Coefficient of linear expansion,

$$\alpha = \frac{\gamma}{3} = \frac{6 \times 10^{-5}}{3} = 2 \times 10^{-5}\ {}^0C^{-1}$$

40.

(c) transverse and stationary

Explanation: transverse and stationary

41.

(b) 1412 Hz

Explanation: $n' = n\ (v + v_0/v + v_s)$

Now, $V_c = 18 \text{ x } \frac{5}{18} = 5 m/s$

Also, $n' = n\ (v + v_M/v + v_c)$

Now, $v_M = 36 \times \frac{5}{18} = 10$ m/s

Hence, $1392 \times (343 + \frac{10}{343} + 5)$

$n' = 1392 \times \frac{353}{348} = 1412$ Hz

42.

(d) 1:4

Explanation: Let the radii be r_1 and r_2 respectively.

Since there are two turns of radius r_2, $r_1 = 2r_2$

Magnetic field B at the center of the coil of radius r_1, $B_1 = \frac{\mu_o i}{2r_1} = \frac{\mu_o i}{4r_2}$

Magnetic field B at the center of the coil of radius r_2 $B_2 = 2 \times \frac{\mu_o i}{2r_2}$

$$\therefore \frac{B_2}{B_1} = \frac{2 \times \frac{\mu_o i}{2r_2}}{\frac{\mu_o i}{4r_2}} = 4$$

$$\Rightarrow \frac{B_1}{B_2} = \frac{1}{4}$$

43.

(c) on the line perpendicular to the axis of the magnet

Explanation: When a bar magnet is placed with its south pole pointing towards the geographic south, neutral points are located on the equatorial line of the magnet.

44.

(c) 125

Explanation: As $\phi = BA\ \cos\theta$

So, $\phi = \mu_0 \mu_r \frac{N}{J} IA\cos 0°$

$$\Rightarrow 4\pi \times 10^{-6} = 4\pi \times 10^{-7} \times \mu_r \times \frac{400}{0.4} \times 0.4 \times 2 \times 10^{-4}$$

$$\Rightarrow \mu_r = 125$$

45.

(d) 500

Explanation: $\frac{e_s}{e_p} = \frac{N_s}{N_p}$ or $\frac{220}{2200} = \frac{N_s}{5000}$

$\therefore N_s = 500$

46.

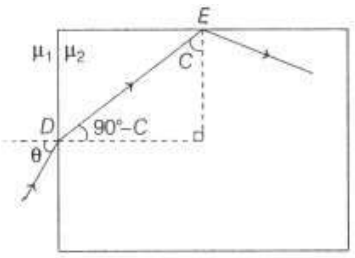
(c) $\frac{3t}{c}$

Explanation: $\frac{3t}{c}$

47. **(a)** $\theta < \sin^{-1}\sqrt{\frac{\mu_2^2}{\mu_1^2} - 1}$

Explanation:

For total internal reflection, angle of incidence(f) at the medium interface must be greater than a critical angle (C).



where,

$$\sin C = \frac{\mu_1}{\mu_2} \text{ ....(i)}$$

Now, in given arrangement,
at point,

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1} \text{ (snell's law)}$$

$$\Rightarrow \frac{\sin\theta}{\sin\left(90° - C\right)} = \frac{\mu_2}{\mu_1} \Rightarrow \frac{\sin\theta}{\cos C} = \frac{\mu_2}{\mu_1}$$

$$\Rightarrow \sin\theta = \frac{\mu_2}{\mu_1} \cdot \cos C = \frac{\mu_2}{\mu_1}\sqrt{1 - \sin^2 C} \text{ [From Eq. (i)]}$$

$$= \frac{\mu_2}{\mu_1}\sqrt{1 - \frac{\mu_1^2}{\mu_2^2}} = \sqrt{\frac{\mu_2^2}{\mu_1^2} - 1} \Rightarrow \theta = \sin^{-1}\sqrt{\left(\frac{\mu_2^2}{\mu_1^2} - 1\right)}$$

For TIR at E,i >C

$$\theta < \sin^{-1}\sqrt{\frac{\mu_2^2}{\mu_1^2} - 1}$$

48.

o

(c) 2 A

Explanation: de Broglie wavelength of a particle associated with its kinetic energy is

$$\lambda = \frac{h}{\sqrt{2mK}}$$

$$\therefore \quad \frac{\lambda_1}{\lambda_2} = \frac{\sqrt{K_2}}{\sqrt{K_1}}$$

$$\text{or } \frac{2000\overset{o}{A}}{\lambda_2} = \sqrt{\frac{1\times10^6 \text{eV}}{1\text{eV}}} = 10^3$$

$$\therefore \quad \lambda_2 = \frac{2000}{10^3} = 2\overset{o}{\text{A}}$$

49.

(c) line spectrum

Explanation: line spectrum

50. **(a)** $\frac{1}{8}$

Explanation: $n = \frac{72000}{24000} = 3$, Now $\frac{N}{N_0} = \left(\frac{1}{2}\right)^n = \frac{1}{8}$

CHEMISTRY (Section-A)

51.

(b) 3.93×10^{-2} g

Explanation: $0.355 \text{ g Al} = \frac{0.355}{27} = 0.0131 \text{ mol Al}$

Balanced reaction:

$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$

Using reaction stoichiometry,

$2 \text{ mol Al} \equiv 3 \text{ mol } H_2$

$1 \text{ mol Al} \equiv \frac{3}{2} \text{ mol } H_2$

$\therefore 0.0131 \text{ mol Al} = 0.0131 \times \frac{3}{2} \text{ mol } H_2$

$= 0.01965 \text{ mol } H_2$

$= 0.01965 \times 2 \text{ g } H_2$

$= 3.93 \times 10^{-2} \text{ g } H_2$

52.

(d) O^{-2}

Explanation: ${}^{16}_{8}O^-$ have more electrons than neutron

p = 8, e = 10, n = 8

53.

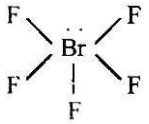
(c) Statements 1, 2 and 3

Explanation: Statements 1, 2 and 3

54. **(a)** PF_5

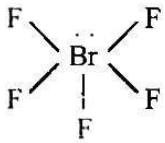
Explanation:

a. BrF_5



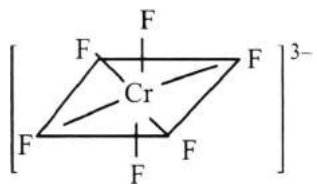
sp^3d^2

b. SF_6



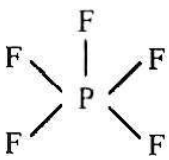
sp^3d^2

c. $[CrF_6]^{3-}$



sp^3d^2

d. PF_5

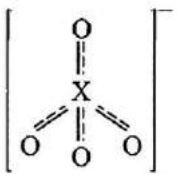


sp^3d

55.

(d) IO_4^-, ClO_4^-

Explanation:



All angles are identical.

56.

(b) NH_4Cl

Explanation: $\left[\begin{array}{c} H \\ | \\ H-N-H \\ | \\ H \end{array}\right]^+ [Cl^-]$

57.

(c) -3RT

Explanation: $\Delta H = \Delta E + \Delta n_g RT$

$\Delta n_g = 3 - (1 + 5) = -3$

$\Rightarrow \Delta H = \Delta E + -3RT$

$\Delta H - \Delta E = -3RT$

58.

(d) 2×10^{-4} M

Explanation: $pH = pK_a + \log \frac{[\text{ Conjugate base }]}{[\text{ Acid }]}$

$pH = pK_a + \log 1$ ($\because$ 50% neutralisation)

$\therefore$ $-\log H^+ = -\log 2 \times 10^{-4}$

or $H^+ = 2 \times 10^{-4}$ M

59.

(d) (ii), (iv)

Explanation: In reactions (b) and (d), H_2O_2 is oxidized and acts as reducing agent.

In reactions (a) and (c), H_2O_2 is reduced and acts as oxidizing agent.

i. $H_2O_2 + 2H^+ + 2e^- \longrightarrow 2H_2O$, A molecule of H_2O_2 loses an O atom and is reduced.

ii. $H_2O_2 - 2e \longrightarrow O_2 + 2H^+$, A molecule of H_2O_2 loses 2 electrons and is oxidized.

iii. $H_2O_2 + 2e \longrightarrow 2(OH^-)$, A molecule of H_2O_2 gains 2 electrons and is reduced.

iv. $H_2O_2 + 2OH^- - 2e \longrightarrow O_2 + 2H_2O$, A molecule of H_2O_2 loses 2 hydrogens and is oxidized.

60.

(c) $FeSO_4$

Explanation: $Mn^{+7} + 5e \rightarrow Mn^{2+}$

$FeSO_4 : Fe^{2+} \rightarrow Fe^{3+} + e$

$Fe(NO_2)_2 : Fe^{2+} \rightarrow Fe^{3+} + e$

$(N^{3+})_2 \rightarrow 2N^{5+} + 4e$

$Fe(C_2O_4)_2 : Fe^{2+} \rightarrow Fe^{3+} + e$

$(C^{3+})_2 \rightarrow 2C^{4+} + 2e$

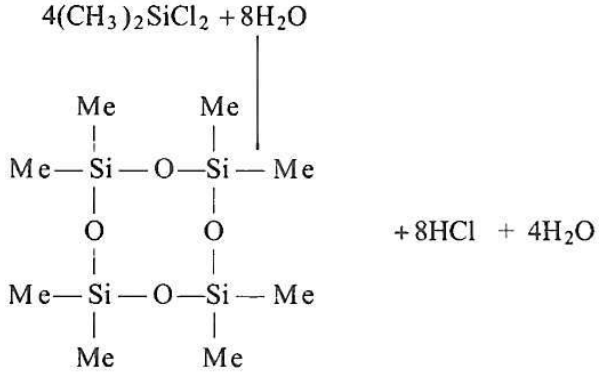
$FeSO_3 : Fe^{2+} \rightarrow Fe^{3+} + e$

$S^{4+} \rightarrow S^{6+} + 2e$

61. **(a)** $(CH_3)_2SiCl_2$

Explanation:

It is prepared by hydrolysis of



62.

(d) Colemanite

Explanation: Colemanite is an ore of boron.

63.

(c) 4

Explanation: Isomeric alcohols with molecular formula $C_4H_{10}O$:

$CH_3 - CH_2 - CH_2 - CH_2 - OHButan-1-ol$

$CH_3 - CH_2 - \underset{OH}{\underset{|}{CH}} - CH_3 Butan-2-ol$

$CH_3 - \underset{CH_3}{\underset{|}{C}}H - CH_3 - OH 2-Methylpropan-2-ol$

$CH_3 - \underset{CH_3}{\underset{|}{CH}} - CH_2 - OH 2-Methylpropan-1-ol$

64.

(b) n-propane

Explanation: $H_3C - \underset{\text{Sodium salt of isobutyric acid}}{\underset{CH_3}{\underset{|}{C}}H - COONa} + NaOH \xrightarrow[\Delta]{CaO} H_3C - \underset{n-Pr}{\underset{CH_3}{\underset{|}{C}}H} - Na_2CO_3$

65. **(a)** benzenoid

Explanation: benzenoid

66.

(d) 100.08

Explanation: \DeltaT$_b$ = K \times molality = 0.51 \times 0.69 = 0.352;

\therefore boiling point = 99.725 + 0.352 = 100.077°C

67.

(b) 1 : 2 : 3

Explanation: 1 mole urea gives 1 mole

1 mole NaCl gives 2 mole
1 mole Na_2SO_4 gives 3 mole
\therefore \DeltaT ratio 1 : 2 : 3

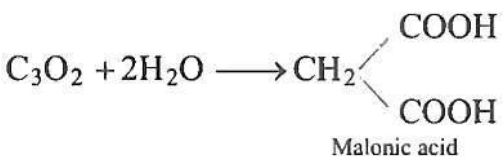
68.
(c) Copper and $HCl_{(aq)}$
Explanation: As copper is placed below hydrogen in the electrochemical series, thus copper does not give hydrogen with dilute acids. While all other will give hydrogen.
Fe + dilute H_2SO_4 \rightarrow $FeSO_4 + H_2$\uparrow
$3Fe + 4H_2O$ \rightarrow $Fe_3O_4 + 4H_2$\uparrow
$2Na + C_2H_5OH$ \rightarrow $2C_2H_5ONa + H_2$\uparrow
Cu + dil. HCl \rightarrow No reaction

69.
(d) t_{\frac 12}
Explanation: The point of intersection of the two curves represents t_{\frac 12}. The intersection point indicates that half of the reactant X is converted into Y. The time in which the concentration of a reactant is reduced to half of its original value is called half-life period of the reaction.

70. **(a)** 166
Explanation: For the reaction, $H_2 + I_2$ \longrightarrow2HI
Given, $k_1 = 2.5 \times10^{-4}$ dm^3 mol^{-1} s^{-1}
$T_1 = (273 + 327)$ K = 600 K
$k_2 = 1$ dm^3 mol^{-1} s^{-1} at $T_2 = (273 + 527)$ K = 800 K
Now, \log \frac{k_{2}}{k_{1}}=\frac{E_{a}}{2.303 R}\left(\frac{T_{2}-T_{1}}{T_{1} T_{2}}\right)
\Rightarrow \log \frac{1}{2.5 \times 10^{-4}}=\frac{E_{a}}{2.303 \times 8.314 \times 10^{-3}}\left(\frac{800-600}{600 \times 800}\right)
\Rightarrow \log \frac{\left(10 \times 10^{3}\right)}{2.5}=\frac{E_{a}}{0.019} \times \frac{200}{48 \times 10^{4}}
\Rightarrow log4 + 3log10 \simeq E_a \times 0. 022
\Rightarrow E_{a}=\frac{2 \times \log 2+3}{0.022}
= \frac{3.6}{0.022} \simeq 163.6 kJ mol^{-1}

71. **(a)** Ac
Explanation: Inner transition element belongs to group 3. Ac has +3 oxidation state.

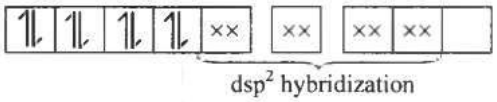
72.
(b) C_3O_2
Explanation:



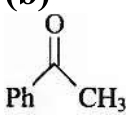
Malonic acid

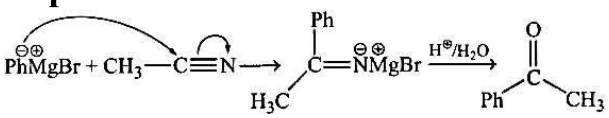
73. **(a)** magnetic moment in solid state
Explanation: magnetic moment in solid state

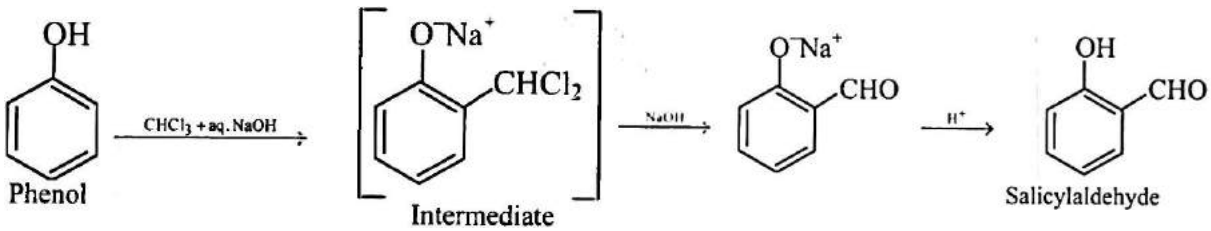
74.
(c) dsp^2
Explanation:
In $[Ni(CN)_4]^{2-}$, Ni has +2 oxidation state.
Ni^{2+} \Rightarrow $[Ar]^3d^8 4s^0$

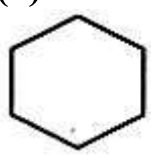
$[Ni(CN)_4]^{2-}$ = 

75.
(c) both magnetic moment and structure
Explanation: both magnetic moment and structure

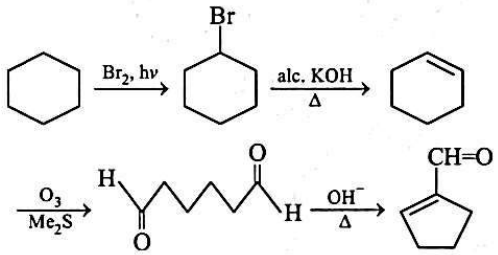
76.
(b)


Explanation:


77.
(c) -CHO
Explanation:
On treating phenol with chloroform in the presence of sodium hydroxide, a -CHO group is introduced at the ortho position of the benzene ring. This reaction is known as the Reimer-Tiemann reaction.


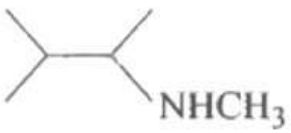
78.
(b)


Explanation:

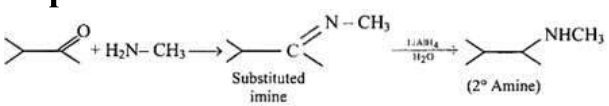


79.

(b)



Explanation:



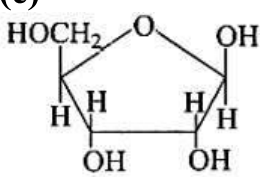
80.

(b) pyranose structure

Explanation: pyranose structure

81.

(c)

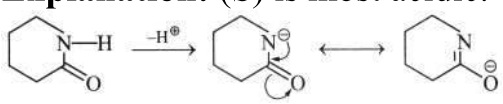


Explanation: Compound which differ in configuration across C-1.

82.

(c) S > P > Q > R

Explanation: (S) is most acidic.



83.

(b) 390.71 S cm^2 mol^1

Explanation: The molar conductivity of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91 S cm^2 mol^{-1} respectively. The molar conductivity of CH_3 COOH at infinite dilution is 390.71 S cm^2 mol^{-1}.

The calculations are as shown below:

\lambda_{{CH}_{3} {COOH}}^{\infty}=\lambda_{{CH}_{3} {COONa}}^{\infty}+\lambda_{{HCl}}^{\infty}-\lambda_{{NaCl}}^{\infty}

\lambda_{{CH}_{3} {COOH}}^{\infty} = 91 S cm^2 mol^{-1} + 426.16 S cm^2 mol^{-1} - 126.45 S cm^2 mol^{-1}

\lambda_{{CH}_{3} {COOH}}^{\infty} = 390.71 S cm^2 mol^1

84. **(a)** NaCN, Na_2S and NaSCN

Explanation: Sulphanilic acid is p-aminobenzenesulforic acid [i.e., p-(H_2N - C_6H_5 - SO_3H)]. Thus, NaCN, NaSCN and Na_2S all are formed in the Lassaigne's extract.

85. **(a)** Copper ferrocyanide

Explanation: When acetic and $K_4Fe(CN)_6$ is added to a copper salt a chocolate precipitate is obtained of the copper ferrocyanide compound.

CHEMISTRY (Section-B)

86. **(a)** {H_2}S

Explanation: In Water, the oxygen atom is highly electronegative and can polarize (partially) the **hydrogen** atoms, thus **hydrogen-hydrogen bonds** between the H_2O molecules can be formed creating a very high boiling point.
In {H_2}S , those **bonds** don't exist, because sulfur is much less electronegative.

87.

(d) only ii

Explanation: $2(H^{-1})$ \rightarrow $(H^0)_2 + 2e$

88.

(c) All of these

Explanation: All of these

89.

(b) nitrogen family

Explanation: nitrogen family

90.

(b) Pauli

Explanation: Pauli

91.

(b) S_8 is only allotropic form of sulphur

Explanation: There are different allotropes of sulphur called monoclinic sulphur, plastic sulphur, orthorhombic sulphur. S_8 is not the only allotrope of sulphur. The remaining statements are correct.

92. **(a)** 2R

Explanation: Arrhenius equation: k = Ae^{-\frac {Ea}{RT}}
In k = In A - \left(\frac{E_{a}}{R}\right) \frac{1}{T}
In k = In A - \left(\frac{E_{a}}{R \times 10^{3}}\right) \times \frac{10^{3}}{T}
Slope of graph = \frac{-E_{a}}{R \times 10^{3}}=\frac{-10}{5}

$E_a = 2R \times 10^3$ J = 2R kJ

93.

(b) \frac{E_{1}+E_{2}}{0.118}

Explanation: $E_1 = E^o = \frac{0.059}{1} \log [H^+]_1$

$E_2 = E^o - \frac{0.059}{1} \log [H^+]_2$

On adding (also E_{\mathrm{H}}^{\circ} = 0)

$E_1 + E_2 = -\frac{0.059}{1} [\log [H^+]_1 + \log [H^+]_2]$

Now for $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

$\left[\mathrm{H}^{+}\right]=\frac{K_{a}\left[\mathrm{CH}_{3} \mathrm{COOH}\right]}{\left[\mathrm{CH}_{3} \mathrm{COO}^{-}\right]}$

$\therefore [H^+]_1 = K_{a} \frac{y}{x}$

$[H^+]_2 = K_{a} \frac{y}{x}$

$\therefore E_1 + E_2 = -\frac{0.059}{1}\left[\log \frac{K_{a} y}{x}+\log \frac{K_{a} x}{y}\right]$

$= - 0.0592 [2 \log K_a]$

$\log K_a = \frac{E_{1}+E_{2}}{2 \times(-0.059)}$

$\log K_a = -\frac{E_{1}+E_{2}}{0.118}$

or $pK_a = \frac{\left(E_{1}+E_{2}\right)}{0.118}$

94.

(b) $A + B^+ \longrightarrow A^+ + B$

Explanation: From the given expression:

At anode: $A \longrightarrow A^+ + e^-$

At cathode: $B^+ + e^- \longrightarrow B$

Overall reaction is: $A + B^+ \longrightarrow A^+ + B$

95.

(d) $E_1 < E_2$

Explanation: Arrhenius equation,

$K = Ae^{\frac{-Ea}{RT}}$

Larger is rate constant, lesser is energy of activation so $E_1 < E_2$

96.

(b) Ag_2CO_3

Explanation: Ag_2CO_3

97.

(b) $CO + CO_2 + H_2O$

Explanation: $\mathop {{{({\text{COOH}})}_2}}\limits_{{\text{Oxalic acid}}} \xrightarrow[\Delta]{{{\text{H}}_2}{\text{S}}{{\text{O}}_4}}{\text{CO}} + {\text{C}}{{\text{O}}_2} + {{\text{H}}_2}{\text{O}}$

98.

(b) Eu^{2+} and Ce^{4+}

Explanation: Ce^{4+} has empty of sunbell so it gains electrons thus, strongly oxidixing.

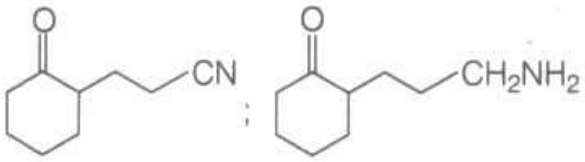
99. **(a)** $[CoBr_4]^{2-}$

Explanation: $Co^{2+} = (3d^5)$

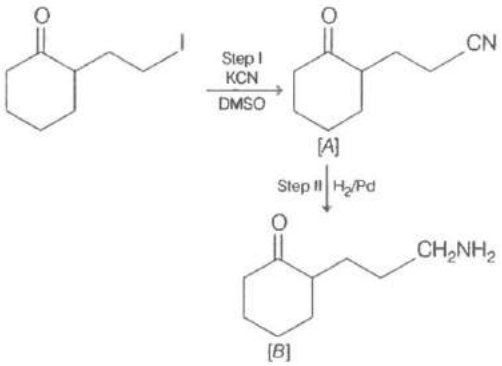
Bromine is a weak ligand but it is known that all tetrahedral complexes are high-spin

regardless of the splitting power of the ligand. The low spin arrangement has five unpaired electrons in the d-orbital. So it is paramagnetic in nature.

100.

(c) 

Explanation:



Step I involves the nucleophilic substitution reaction in which I(Iodine) is substituted by -CN group.

In **Step II**, H_2/Pd reagent is used for reduction process. Here, -CN group reduces itself to -CH_2NH_2.

BOTANY (Section-A)

101.

(b) Both Monographs and Flora

Explanation: Flora contains the actual account of the habitat and distribution of plants in a given area. Monographs contain information on any one taxon. Hence, Both monographs and flora are used in the preparation of taxonomic tools which identifies and classifies plants and animals.

102.

(d) can reproduce freely with each other and form seeds.

Explanation: Two plants can be conclusively said to belong to the same species if they can reproduce freely with each other and form seeds.

103.

(b) Agaricus, Ustilago and Puccinia

Explanation: Agaricus, Ustilago, and Puccinia belong to basidiomycetes as they all have branched and septate mycelium. They vegetatively reproduce by fragmentation and possess basidiospores as their sexual spores.

104.

(c) Animal with red blood and without red blood

Explanation: Aristotle classified animals in two groups, those which have red blood and those that did not.

105.

(c) Tapetum nourishes the developing pollen

Explanation: Tapetum nourishes the developing pollen grains.

106.

(d) Pteridophyta

Explanation: A cryptogam is a plant that reproduces by spores, without flowers or seeds. Pteridophytes are the first terrestrial plants to possess vascular tissues – xylem and phloem (vascular tissue).

107.

(c) Fragmentation

Explanation: Spirogyra is green algae and algae reproduce by vegetative, asexual, and sexual methods. Vegetative reproduction is by fragmentation. Each fragment develops into a thallus.

108.

(d) Remnant of nucellus

Explanation: Remnant of nucellus

109.

(d) Wheat

Explanation: Wheat is an anemophilous or wind-pollinated plant. Stigma is the receptive tip of the carpel in the gynoecium of a flower. It receives pollen at pollination. The feathery stigma is characteristic of wind pollination.

110. **(a)** Placenta

Explanation: The tissue which attaches the ovules inside the ovary is **placenta**. In flowering plants, placentation occurs where the ovules are attached inside the ovary. The ovules inside a flower's ovary are attached via funiculi, the plant part equivalent to an umbilical cord.

111.

(b) Exarch

Explanation: The vascular bundle with centripetal xylem is called Exarch xylem.

112.

(b) broader lumen and perforated cross walls

Explanation: Sieve tubes are suited for translocation of food because they possess broader lumen and perforated cross walls. Sieve tubes are elongated tubular conducting channels of phloem. The end wall possesses many small pores and have thin cellulosic wall.

113.

(c) Trichomes - Glandular or non-glandular

Explanation: Trichomes - Glandular or non-glandular

114.

(b) Change in autosomes

Explanation: Change in autosomes

115.

(b) Motor proteins

Explanation: Motor proteins facilitate the targeting and trafficking of proteins to the endoplasmic reticulum (ER).

116. **(a)** Five

Explanation: Five

117.

(d) (ii), (v)

Explanation: (ii), (v)

118.

(c) (A) is true but (B) is false

Explanation: (A) is true but (B) is false.

Both mitochondria and chloroplast are semiautonomous cell organelles because their structure and functioning are partially controlled by the nucleus of the cell and the availability of materials from the cytoplasm.

119. **(a)** Cell-mediated immune response

Explanation: Cell-mediated immune response

120. **(a)** Morphine, codeine, heroine

Explanation: Morphine, codeine, heroine

121. **(a)** G_1 - S - G_2 - M

Explanation: G_1 - S - G_2 - M

122.

(d) (i), (ii), (iii) and (iv)

Explanation:

- All birds and mammals and a very few lower vertebrate and invertebrate species are indeed capable of such regulation (thermoregulation and osmoregulation).
- An overwhelming majority (99 percent) of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. In aquatic animals, the osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration. These animals and plants are simply conformers.
- Many animals, particularly birds, during winter undertake long-distance migrations to more hospitable areas. Every winter the famous Keoladeo National Park (Bharatpur) in Rajasthan hosts thousands of migratory birds coming from Siberia and other extremely cold northern regions.
- Bears going into hibernation during winter and some snails and fish go into aestivation to avoid summer-related problems-heat and desiccation.
- Under unfavourable conditions, many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

123.

(b) an energy links.

Explanation: The model that shows how energy passes from one trophic level to another trophic level is called an energy links.

124.

(b) Serratia - Drug addiction

Explanation: Serratia - Nosocomial infections

125.

(c) (1) - hibernation, (2) - escape, (3) - expanding (5) - hot spot

Explanation: (1) - hibernation, (2) - escape, (3) - expanding (5) - hot spot

126.

(c) Cheetah

Explanation: Animal which get extincted in the last few years are Indian Cheetah, Rhino, Chinese paddlefish, Yangtze giant softshell turtle, Spix Macaw, Catarina Pupfish, and Indochinese tiger.

127.

(c) (ii), (iii) and (iv)

Explanation: The following factors best explain these contrasting patterns:

ii. Because of high species diversity in the tropics, individuals of tree species are often widely separated making wind an inefficient means of pollen dispersal.

iii. More opportunities for coevolved mutualisms exist in tropical forests because of the high diversity of animal species.

iv. Trees in tropical forests are mostly evergreen and year-round leaf canopies impede pollen dispersal by wind.

128.

(c) Pole ward movement of chromosomes

Explanation: The centromere is present in every cell. It is specifically useful in the process of cell division. During mitosis, the spindle fibers attach to the centromeres via kinetochore and all the chromosomes are arranged in an equatorial plane. After this, the chromosomes move towards their respective poles and cell division takes place.

129.

(b) Starting of metaphase

Explanation: In **Metaphase** condensation of chromosomes is completed and they are in coiled form. Hence, they can be observed clearly under the microscope. The morphology of chromosomes is most easily studied. Spindle fibres attach to the kinetochores of chromosomes.

130.

(c) Option (c) is correct.

Explanation: PS I is located in the non-appressed part of thylakoids and stroma lamellae and PS II is present in the appressed part of thylakoids. Stroma is the site of dark reaction and thylakoid is the site of light reaction.

131.

(c) (A) - (iii), (B) - (iv), (C) - (i), (D) - (ii)

Explanation: (A) - (iii), (B) - (iv), (C) - (i), (D) - (ii)

132. **(a)** (i), (ii), (iii), (iv) and (v)

Explanation: (i), (ii), (iii), (iv) and (v)

133. **(a)** chlorophyll

Explanation: Other factors are external factors where chlorophyll is a plant or internal factor affecting photosynthesis.

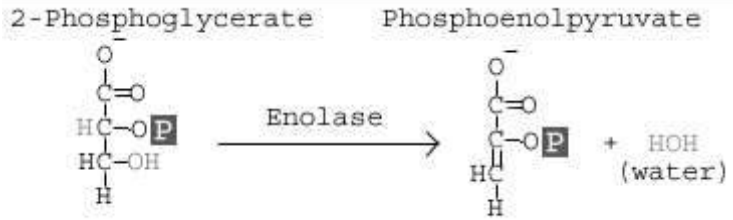
134.

(d) 2-Phosphoglycerate \longrightarrow Phosphoenol pyruvate

Explanation:

During the formation of phosphoenol pyruvate (PEP) from 2-phosphoglycerate, a water molecule is eliminated. This reaction is catalysed by the enzyme enolase. This is a step of

glycolysis. This reaction takes place in the cytoplasm.



135.

(b) Gibberellins

Explanation: Auxins promote flowering e.g., in pineapples. They help to prevent fruit and leaf drop at early stages but promote the abscission of older mature leaves and fruits.

BOTANY (Section-B)

136.

(c) Chordata

Explanation: Man is placed in Phylum Chordata which possess a notochord and a dorsal nerve cord during some period of their life cycle.

137.

(b) Numerical taxonomy

Explanation: In numerical taxonomy, numbers and codes are assigned to each morphological character and the data then processed. Thus all the characters are given equal importance.

138.

(d) The sexual reproduction only oogamous

Explanation: In Chlorophyceae, vegetative reproduction usually takes place by fragmentation or by the formation of different types of spores. Asexual reproduction is by flagellated zoospores produced in zoosporangia. Sexual reproduction shows considerable variation in the type and formation of sex cells and it may be isogamous, anisogamous, or oogamous.

139.

(c) an egg cell and a male gamete.

Explanation: The embryo develops from zygote which results from the fusion of a male gamete with the egg cell.

140.

(b) (A) - (iii), (B) - (i), (C) - (iv), (D) - (v), (E) - (ii)

Explanation: The correct order of matching is (A) - (iii), (B) - (i), (C) - (iv), (D) - (v), (E) - (ii).

141. **(a)** 3 pairs of autosomes and 1 pair of sex chromosomes

Explanation: Drosophila melanogaster has a total of four pairs of chromosomes, three pairs of autosomes, and one pair of sex chromosomes.

142. **(a)** Pentose sugar, Phosphoric acid, Pyrimidines and Purines

Explanation: Pentose sugar, Phosphoric acid, Pyrimidines and Purines

143. **(a)** Lysosomes are double membraned vesicles budded off from Golgi apparatus and contain digestive enzymes.

Explanation: Lysosomes are simple tiny spherical sac-like structures evenly distributed in

the cytoplasm. These are formed by the process of packaging in golgi apparatus. They are bounded by a single membrane. They are rich in hydrolytic enzymes such as lipases, proteases, and carbohydrases.

144. **(a)** Aspergillus
Explanation: Aspergillus niger produces citric acid, Clostridium butylicum produces butyric acid, Saccharomyces is used for commercial production of ethanol, Pseudomonas produces alkaline proteases.

145.
(c) The cycle starts with the condensation of acetyl group (Acetyl CoA) with pyruvic acid to yield citric acid
Explanation: The cycle starts with the condensation of acetyl group (Acetyl CoA) with pyruvic acid to yield citric acid

146.
(d) Processed by aerobic and then anaerobic bacteria in the secondary treatment in Sewage Treatment Plant (STPs)
Explanation: Sewage water can be purified by passing it through sewage treatment plants with the action of heterotrophic microorganisms. There are three stages of this treatment - primary, secondary and tertiary. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As the BOD of the waste matter is reduced to 10-15% of raw sewage, it is passed into settling tank. Thus secondary treatment is more or less biological. The sediment of settling tank is called activated sludge. The remaining is passed into a large tank called anaerobic sludge digester. The aerobic microbes present in the sludge get killed. Anaerobic microbes digest the organic mass as well as aerobic microbes of the sludge.

147.
(b) A
Explanation: Grass-Grasshopper-Frog-Snake-Hawk

148.
(b) Gibberellic acid (GA)
Explanation: Gibberellic acid (GA)

149.
(b) Stomatal closure
Explanation: Stomatal closure

150. **(a)** C_3 plants responds to higher temperature with enhanced photosynthesis while C_4 plants have much lower temperature optimum
Explanation: C_3 plants have RuBisCo enzyme which gets activated on higher carbon dioxide concentration. C_4 plants have PEP as a major CO_2 acceptor. Photosynthetic activity is mainly affected by enzymes rather than temperatures. High temperature leads to the destruction of photosynthetic pigments.

ZOOLOGY (Section-A)

151.
(c) None of these
Explanation: Archaeocytes are amoeboid cells found in sponges that are totipotent in

nature and perform a variety of functions. Myocytes are small muscular cells that open and close the porocytes help in closing and opening the osculum. Choanocytes or collar cells line the spongocoel and the canals in sponges. Hence, all three types of cells are associated with sponges.

152.

(c) Metagenesis

Explanation: Alternation of generation in which both polyp and medusa stage is present is called as metagenesis.

153.

(b) A, C and D

Explanation: Crocodile is a reptile having a four-chambered heart. In Obelia, there is an alternation of the generation called metagenesis, and a lemur is a mammal in which thecodont dentition is found.

154. **(a)** Iris - involuntary smooth muscle

Explanation: The iris contains involuntary smooth muscles. It encircles the pupil of the iris and helps to dilate the pupil when there is insufficient light for the normal function of the eye.

155.

(c) Mucosa

Explanation: Peyer's Patches are the lymphoid follicles located in the mucosa and extending into the submucosa of the small intestine.

156.

(d) (A)-(iv), (B)-(iii), (C)-(i), (D)-(v), (E)-(vi), (F)-(ii)

Explanation: (A)-(iv), (B)-(iii), (C)-(i), (D)-(v), (E)-(vi), (F)-(ii)

157.

(d) Oxygen carrying capacity of haemoglobin decreases

Explanation: If human blood becomes acidic, oxygen carrying capacity of haemoglobin decreases.

158. **(a)** in CO_2 transport, buffers play an important role.

Explanation: Blood does not become acidic due to the buffering action of bicarbonates. \mathrm{H}_2 \mathrm{O}+\mathrm{CO}_2 \quad \mathrm{H}_2 \mathrm{CO}_3 \quad \mathrm{H}^{+}+\mathrm{HCO}_3^{-}

159. **(a)** Tidal volume

Explanation: During normal breathing, the volume of air inspired or expired is known as tidal volume. Its value is approximately 500 ml. Vital capacity is defined as the maximum volume of air a person can breathe in after a forceful expiration or the maximum volume of air a person can breathe out after a forceful inspiration. This includes expiratory reserve volume, tidal volume and inspiratory reserve volume. Depending on the age, sex, and height of the individual, its value varies from 3400 ml and 4800 ml. Inspiratory reserve volume is defined as the additional or extra volume of air, a person can inspire by forceful inspiration. This volume averages 2500 ml to 3000 ml. Expiratory reserve volume is defined as the additional or extra volume of air, a person expires by forceful expiration. This volume averages 1000 ml to 1100 ml. So, the tidal volume has the lowest value.

160.

(c) Statement (d) is incorrect.

Explanation: In insects, blood (haemolymph) does not contain an oxygen-carrying pigment. Hence, it does not help in respiration. Instead, insects have spiracles and tracheae that carry O_2 to different tissues.

161.

(c) Appearance of secondary sexual characters

Explanation: Appearance of secondary sexual characters

162.

(b) (B), (C) and (D)

Explanation: Both LH and FSH attain a peak level in the middle of the cycle (about 14th day). Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces ruplure of Graafian follicle and thereby the release of ovum (ovulation).

163.

(b) A - (ii), B - (i), C - (iv), D - (iii)

Explanation: The colostrum is the milk produced during the initial few days of lactation from mammary glands. The remaining parts of the Graafian follicle transform as the corpus luteum which secretes large amounts of progesterone. Capacitation is a functional maturation of the spermatozoon. During gastrulation, blastocyst transforms into gastrula with primary germ layers by rearrangement of the cells by characteristic movements of some of the cells known as morphogenetic movements.

164.

(b) 15 weeks

Explanation: 15 weeks

165.

(c) Increased health facilities along with better living conditions

Explanation: Increased health facilities along with better living conditions

166. **(a)** 900 cc

Explanation: 900 cc

167.

(d) (i), (ii), (iii), and (iv)

Explanation: The monomeric units formed due to chemical evolution polymerised to form polymeric units. These large organic molecules later came together and due to intermolecular attraction, and formed large colloidal aggregates called protobionts. Coacervates and microspheres are two large protobionts. Coacervates are microscopic spontaneously formed spherical aggregates of lipid molecules that are held together by electrostatic forces and that may have been precursors of cells. The first non-cellular forms of life could have originated 3 billion years back. They would have been giant molecules (RNA, protein, polysaccharides, etc.). These capsules reproduced their molecules perhaps.

168. **(a)** Collecting duct

Explanation: Uriniferous tubule or nephron is the structural and functional unit of the kidney. It is present in the outer firm region of the kidney, the renal cortex. It consists of a renal corpuscle and a long renal tubule. Renal corpuscle comprises of glomerulus and Bowman's capsule. Renal tubule comprises of the proximal convoluted tubule, loop of

Henle, and distal convoluted tubule.
Whereas collecting duct is present in the inner region of the kidney, the renal medulla. It carries the urine from the nephron in the cortex to the pelvis in the kidney. It is not part of one nephron but it is formed with the distal of many nephrons.

169. **(a)** Hilus
Explanation: Hilus

170.
(b) 10cm \times 5cm \times 3cm
Explanation: 10cm \times 5cm \times 3cm

171.
(c) Muscles
Explanation: Muscles

172.
(c) Myoglobin and cytochrome
Explanation: Muscle is a bundle of fibrous tissue in a body that has the ability to contract, producing movement in or maintaining the position of parts of the body. Muscles appear in red colour due to a pigment called myoglobin. Myoglobin receives oxygen from the red blood cells and transports it to the mitochondria of muscle cells, where the oxygen is used in cellular respiration to produce energy. Cytochrome is a protein associated with the inner membrane of mitochondria. As the number of mitochondria is abundant in red fibres thus represents the abundance of cytochrome in red muscles. Hence red muscles are rich in myoglobin and cytochrome. So, the correct answer is 'Myoglobin and cytochrome'.

173.
(b) Shoulder girdle
Explanation: Two clavicles fuse with one inter-clavicle to form 'Wish bone' or 'Bone of merry thought'.

174.
(d) Cerebrum
Explanation: The cerebrum governs intelligence, thinking, memory and other mental abilities. So, learning is associated with the cerebrum.

175. **(a)** Trigeminal nerve
Explanation: Trigeminal nerve is the largest 5th cranial nerve. It has three branches. Vagus nerve is the 10th cranial nerve and innervates larynx, trachea, oesophagus, stomach, lungs, heart and intestines.
Facial nerve is the 7th cranial nerve and innervates muscles of face and back, taste buds and salivary glands.

176.
(c) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)
Explanation: (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

177. **(a)** Estrogen and parathyroid hormone
Explanation: Estrogen promotes the activity of osteoblast and inhibits osteoclast. In an ageing female osteoporosis occurs due to deficiency of estrogen.
Parathormone promotes the mobilisation of calcium from bone into the blood. Excessive activity of parathormone causes demineralisation leading to osteoporosis.

178.
(c) Goitre
Explanation: Goitre
179.
(d) beat rhythmically
Explanation: If nerves of heart are cut, then heart will beat rhythmically.
180.
(c) 72
Explanation: The heart beats 72 times per minute, that is, 72 cardiac cycles are performed per minute.
181.
(c) Blood plasma
Explanation: Plasma is the liquid portion of the blood that carries nutrients and excretory products to their respective tissues and organs. Hence, urea is transported by blood plasma.
182.
(c) 5'-GAATTC-3'
3'-CTTAAG-5'
Explanation: Palindromic sequences in DNA molecule are group of bases that forms the same sequence when read in both forward and backward direction. In the given question, only option 5'-GAATTC-3', 3'-CTTAAG-5' represents a palindromic sequence.
183.
(c) Cloning of antibiotic resistance gene
Explanation: Cloning of antibiotic resistance gene
184.
(d) cancer
Explanation: Transgenic models exist for many human diseases such as cancer, cystic fibrosis rheumatoid arthritis, Alzheimer's disease, etc.
185.
(b) To produce pest resistant varieties of plant
Explanation: To produce pest resistant varieties of plant

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186.
(c) Cephalochordata
Explanation: In Cephalochordata, the notochord extends from head to tail region and is persistent throughout their life.
187.
(d) Skeletal muscles contract and pull the tendon to move the bones.
Explanation: Skeletal muscles are a type of striated muscle tissue. These muscles are under the control of the somatic nervous system. Skeletal muscles produce movements by pulling on tendons, which in turn, pull on bones.
188.
(c) Both chelone and Frog's tadpole
Explanation: Both Chelone and Frog's tadpole have a closed circulatory system in which

the blood pumped by the heart is always circulated through a closed network of blood vessels.

189.

(c) Pleural membrane

Explanation: Pleural membrane

190. **(a)** Ectoderm

Explanation: Ectoderm

191.

(c) Testes to epididymis

Explanation: Testes to epididymis

192.

(c) Malthus idea of population control

Explanation: Malthus idea of population control

193.

(c) Blood enters glomerulus through efferent arterioles.

Explanation: Blood enters glomerulus through afferent arterioles.

194.

(b) 80 bones

Explanation: The human's axial skeleton is composed of 80 bones and is the central core of the body.

195.

(c) hairs are bent.

Explanation: The organ of Corti is a structure located on the basilar membrane which contains hair cells that act as auditory receptors. Movements of the basilar membrane bend the hair cells, pressing them against the tectorial membrane. As a result, nerve impulses are generated in the associated afferent neurons. These impulses are transmitted by the afferent fibres via auditory nerves to the auditory cortex of the brain, where the impulses are analysed, and the sound is recognised.

196.

(b) Atri-natriuretic factor

Explanation: Atrial-natriuretic factor (ANF) is a cardiac hormone whose main function is to lower blood pressure and to control electrolyte homeostasis. Its main targets are the kidney and the cardiovascular system but ANF interacts with many other hormones in order to regulate their secretion.

197.

(b) (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)

Explanation: Epinephrine/adrenaline is a catecholamine and a biogenic amine. Cortisol is a steroid. Endorphins are natural painkiller.

198.

(c) Only C

Explanation: Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body. It is sometimes called congestive heart failure because congestion of the lungs is one of the main symptoms of this disease.

199. **(a)** Statement (iii) is incorrect.
Explanation: HindII always cut DNA molecules at a particular point by recognising a specific sequence of six base pairs.

200.
(c) Tobacco and cotton
Explanation: Tobacco and cotton