

IMPORTANT INSTRUCTIONS:

1. A seat marked with Reg. No. will be allotted to each student...
2. The test is of **3 hours** duration and this Test Booklet contains **180** questions. Each question carries **4** marks. 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**.
3. In this Test Paper, each subject will consist of 45 questions (all questions are mandatory)
4. Students cannot use log tables, calculators, or any other material in the examination hall.
5.
 - Physics Q.No. 1 - 45**
 - Chemistry Q.No. 46 - 90**
 - Botany Q.No. 91 - 135**
 - Zoology Q.No. 136 - 180**
6. A candidate has to write his/her answer in the **OMR** sheet by darkening the appropriate bubble with the help of **Blue / Black Ball Point Pen** only as the correct answer(s) of the question attempted.

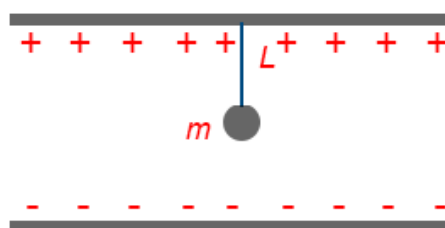
SYLLABUS

Physics:	Electric Charges And Fields.
Chemistry:	Solutions.
Botany:	Sexual Reproduction In Flowering Plants.
Zoology:	Human Reproduction.

(Physics)

1. An electron is sent in electric field of intensity $9.1 \times 10^6 \text{ NC}^{-1}$. The acceleration produced is (mass of electron = $9.1 \times 10^{-31} \text{ kg}$)
 - A) 1.6 ms^{-2}
 - B) $1.6 \times 10^{18} \text{ ms}^{-2}$
 - C) $3.2 \times 10^{18} \text{ ms}^{-2}$
 - D) $0.8 \times 10^{18} \text{ ms}^{-2}$
2. Force between two charges q_1 and q_2 separated by a distance r is proportional to $q_1 q_2 / r^2$. Proportionality constant is
 - A) $\frac{\epsilon_0}{4\pi}$
 - B) $4\pi\epsilon_0$
 - C) $\frac{1}{4\pi\epsilon_0}$
 - D) 1
3. The most efficient semiconductor material is _____.
 - A) Silicon
 - B) Germanium
 - C) Carbon
 - D) All the mentioned

4. A small sphere carrying a charge ' q ' is hanging in between two parallel plates by a string of length L . Time period of pendulum is T_0 . When parallel plates are charged, the time period changes to T . The ratio T/T_0 is equal to

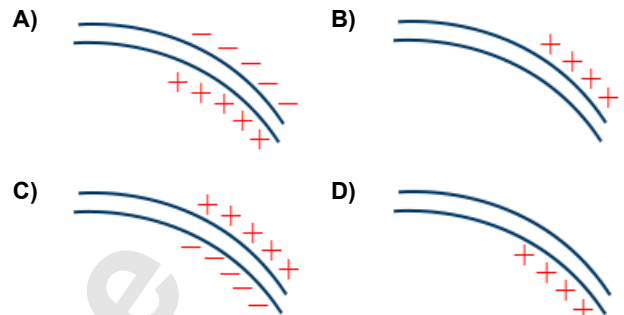


- A) $\left(\frac{g + \frac{qE}{m}}{g}\right)^{1/2}$
 - B) $\left(\frac{g}{g + \frac{qE}{m}}\right)^{3/2}$
 - C) $\left(\frac{g}{g + \frac{qE}{m}}\right)^{1/2}$
 - D) None of these
5. The electric field at the centroid of an equilateral triangle carrying an equal charge q at each of the vertices

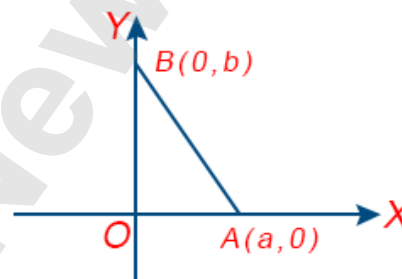
- A) Zero B) $\frac{\sqrt{2}kq}{r^2}$
 C) $\frac{kq}{\sqrt{2}r^2}$ D) $\frac{3kq}{r^2}$
6. Four metal conductors having different shapes
 1. a sphere
 2. cylinder
 3. pear
 4. lightning conductor
 are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is
 A) 1 B) 2
 C) 3 D) 4
7. A point charge is kept at the centre of metallic insulated spherical shell. Then
 A) Electric field out side the sphere is zero B) Electric field inside the sphere is zero
 C) Net induced charge on the sphere is zero D) Electric potential inside the sphere is zero
8. There are two metallic spheres of same radii but one is solid and the other is hollow, then
 A) Solid sphere can be given more charge B) Hollow sphere can be given more charge
 C) They can be charged equally (maximum) D) None of the above
9. Forces exerted by a uniform electric field on an electron having mass m_e and proton of mass m_p are represented as F_e and F_p respectively are related as
 A) $F_p = F_e$ B) $\frac{F_e}{F_p} = \frac{m_e}{m_p}$
 C) $\frac{F_e}{F_p} = \frac{m_p}{m_e}$ D) $\frac{F_e}{F_p} = \frac{m_e^2}{m_p^2}$
10. According to Coulomb's law, the force between two-point charges is proportional to:
 A) The product of their masses B) The square of the distance between them
 C) The difference in their charges D) The sum of their charges
11. A charged oil drop of mass 2.5×10^{-7} kg is in space between the two plates, each of area $2 \times 10^{-2} \text{ m}^2$ of a parallel plate capacitor. When the upper plate has a charge of $5 \times 10^{-7} \text{ C}$ and the lower plate has an equal negative charge, the oil remains stationary. The charge of the oil drop is (Take $g = 10 \text{ m/s}^2$)
 A) $9 \times 10^{-1} \text{ C}$ B) $9 \times 10^{-6} \text{ C}$
 C) $8.35 \times 10^{-13} \text{ C}$ D) $1.8 \times 10^{-14} \text{ C}$
12. A pellet carrying charge of 0.5 coulombs is accelerated through a potential of 2,000 volts, It attains a kinetic energy equal to
 A) 1000 ergs B) 1000 joules
 C) 1000 kWh D) 500 ergs
13. A conducting sphere of radius $R=20 \text{ cm}$ is given a charge $Q = 16 \mu\text{C}$. What is $\vec{E}$ at centre
 A) $3.6 \times 10^6 \text{ N/C}$ B) $1.8 \times 10^6 \text{ N/C}$
 C) Zero D) $0.9 \times 10^6 \text{ N/C}$

14. The workdone in increasing the voltage across the plates of the capacitor from 5v to 10v is W. The workdone in increasing the voltage from 10v to 15v will be
 A) W B) $\frac{4}{3}W$
 C) $\frac{5}{3}W$ D) $2W$

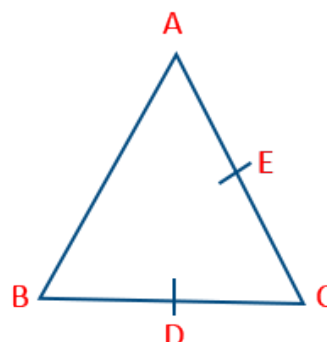
15. Which is the correct representation of the charges on the surface of a conductor at the bend when current is flowing ?



16. A sphere of 4 cm radius is suspended within a hollow sphere of 6 cm radius. The inner sphere is charged to potential 3 e.s.u. and the outer sphere is earthed. The charge on the inner sphere is
 A) 54 e.s.u. B) $\frac{1}{4}$ e.s.u.
 C) 30 e.s.u. D) 36 e.s.u.
17. A charge $+q$ is placed at the origin O of X-Y axes as shown in the figure. The work done in taking a charge Q from A to B along the straight line AB is



- A) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{a-b}{ab} \right)$ B) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{b-a}{ab} \right)$
 C) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{b}{a^2} - \frac{1}{b} \right)$ D) $\frac{qQ}{4\pi\epsilon_0} \left(\frac{a}{b^2} - \frac{1}{b} \right)$
18. What type of dipole is formed when a covalent bond exists between two atoms with different electronegativities?
 A) Induced dipole B) Permanent dipole
 C) Instantaneous dipole D) Ionic dipole
19. Three charges, each $+q$, are placed at the corners of an isosceles triangles ABC of sides BC and AC, 2a. D and E are the mid points of BC and CA. The work done in taking a charge Q from D to E is



- A) $\frac{3qQ}{4\pi\epsilon_0 a}$ B) $\frac{3qQ}{8\pi\epsilon_0 a}$
 C) $\frac{qQ}{4\pi\epsilon_0 a}$ D) Zero
20. An electric dipole consisting of two opposite charges of $2 \times 10^{-6} \text{ C}$ each separated by a distance of 3 cm is placed in an electric field of $2 \times 10^5 \text{ N/C}$. The maximum torque on the dipole will be
 A) $12 \times 10^{-1} \text{ Nm}$ B) $12 \times 10^{-3} \text{ Nm}$
 C) $24 \times 10^{-1} \text{ Nm}$ D) $24 \times 10^{-3} \text{ Nm}$
21. Two unlike charges of the same magnitude Q are placed at a distance d . The intensity of the electric field at the middle point in the line joining the two charges
 A) zero B) $\frac{8Q}{4\pi\epsilon_0 d^2}$
 C) $\frac{6Q}{4\pi\epsilon_0 d^2}$ D) $\frac{4Q}{4\pi\epsilon_0 d^2}$
22. _____ is a kind of insulator.
 A) Mica B) Silicon
 C) Copper D) Silver
23. A non-conducting ring of radius 0.5 m carries a total charge of $1.11 \times 10^{-10} \text{ C}$ distributed non-uniformly on its circumference producing an electric field $\vec{E}$ every where in space. The value of the line integral $\int_{l=\infty}^{l=0} -\vec{E} \cdot d\vec{l}$ ($l = 0$ being centre of the ring) in volts is
 A) +2 B) -1
 C) -2 D) Zero
24. Which group among the following is insulator?
 A) Silver, copper, gold B) Paper, glass, cotton
 C) The human body, wood, iron D) Glass, copper, paper
25. What is the effect of placing a dielectric material between the plates of a parallel plate capacitor on the capacitance?
 A) Increases the capacitance B) Decreases the capacitance
 C) Does not affect the capacitance D) Increases or decreases depending on the material
26. Given the balanced equation: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$ How many grams of H_2O are formed if $9.00 \text{ mol H}_2(\text{g})$ reacts completely with an excess of $\text{O}_2(\text{g})$? The molar mass of H_2O is 18.0 g/mol .
 A) 18.0 g B) 36.0 g
 C) 81.0 g D) 162 g
27. A charge produces an electric field of 1 N/C at a point distant 0.1 m from it. The magnitude of charge is
 A) $1.11 \times 10^{-12} \text{ C}$ B) $9.11 \times 10^{-12} \text{ C}$
 C) $7.11 \times 10^{-6} \text{ C}$ D) None of these

28. An infinitely long straight linear charge of density $\lambda = 60 \mu \text{ cm}^{-1}$ passes through an imaginary cylinder of length $l = 40 \text{ cm}$ and radius 15 cm . A point charge $q = -10 \mu \text{ C}$ is placed outside the cylinder. The maximum net flux coming out of the surface of the cylinder will be ($\epsilon_0 \rightarrow$ permittivity of medium)

A) $\frac{20}{\epsilon_0} \mu \frac{\text{Nm}^2}{\text{C}}$ B) $\frac{30}{\epsilon_0} \mu \frac{\text{Nm}^2}{\text{C}}$
 C) $\frac{40}{\epsilon_0} \mu \frac{\text{Nm}^2}{\text{C}}$ D) $\frac{50}{\epsilon_0} \mu \frac{\text{Nm}^2}{\text{C}}$

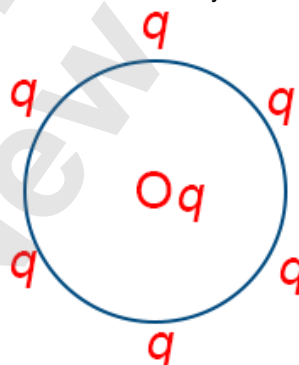
29. What is charge on 90 kg of electrons?
 A) $1.58 \times 10^{13} \text{ C}$ B) $2.3 \times 10^{12} \text{ C}$
 C) $2.53 \times 10^{12} \text{ C}$ D) None of these

30. In the given figure distance of the point from A where the electric field is zero is



- A) 20 cm B) 10 cm
 C) 33 cm D) None of these

31. A point charge q is surrounded by six identical charges at distance r as shown in the below figure. How much work is done by the force of electrostatic repulsion when the point charge at the centre is removed to infinity?



A) Zero B) $\frac{6q^2}{4\pi\epsilon_0 r}$
 C) $\frac{6q}{4\pi\epsilon_0 r}$ D) $\frac{36q^2}{4\pi\epsilon_0 r}$

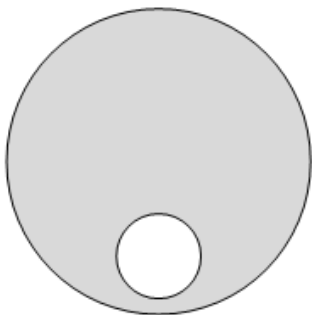
32. Along x-axis at positions $x = 1, x = 2, x = 4$ and $x = 8$ charges q is placed. What will be electric field at $x = 0$ due to these charges. What will be the value of electric field if the charges are alternately positive and negative.

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$x = 1$ $x = 2$ $x = 4$ $x = 8$

A) $\left[\frac{q}{\pi\epsilon_0} \right] \frac{4q}{5}$ B) $\left[\frac{q}{4\pi\epsilon_0} \right] \frac{4q}{5}$
 C) $\left[\frac{q}{4\pi\epsilon_0} \right] \frac{4q}{7}$ D) $\left[\frac{q}{\pi\epsilon_0} \right] \frac{4q}{7}$

33. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure. The electric field inside the emptied space is



- A) Zero everywhere B) Non-zero and uniform
C) Non-uniform D) Zero only at its centre

34. Two positive charges of magnitude q are placed at the ends of a side 1 of a square of side $2a$. Two negative charges of the same magnitude are kept at the other corner. starting from rest, if a charge Q moves from the middle of side 1 to the centre of square, its kinetic energy at the centre of square is

- A) $\frac{1}{4\pi\epsilon_0} \frac{2qQ}{a} \left[1 - \frac{1}{\sqrt{5}}\right]$ B) Zero
C) $\frac{1}{4\pi\epsilon_0} \frac{2qQ}{a} \left[1 + \frac{1}{\sqrt{5}}\right]$ D) $\frac{1}{4\pi\epsilon_0} \frac{2qQ}{a} \left[1 - \frac{2}{\sqrt{5}}\right]$

35. An electric dipole $\vec{P}$ is placed in an electric field $\vec{E}$.

The torque acting on the dipole is

- A) $\vec{P} \cdot \vec{E}$ B) $\vec{P} \times \vec{E}$
C) $\vec{E} \times \vec{P}$ D) $\vec{E} \cdot (\vec{P} \times \vec{E})$

36. Two identical conducting balls A and B have positive charges q_1 and q_2 respectively but $q_1 \neq q_2$.

The balls are brought together so that they touch each other and then kept in their original positions.

The force between them is

- A) Less than that before B) Greater than that before
the balls touched the balls touched
C) Same as that before the D) Zero
balls touched

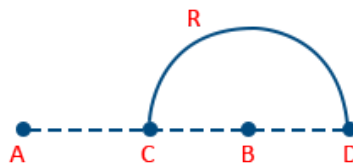
37. A sphere of radius R has a uniform distribution of electric charge in its volume. At a distance x from its centre, for $x < R$, the electric field is directly proportional to

- A) $\frac{1}{x^2}$ B) $\frac{1}{x}$
C) x D) x^2

38. Which factor affects the capacitance of a parallel plate capacitor?

- A) Area of the plates B) Distance between the plates
C) Permittivity of the medium between the plates D) All of the above

39. Charges $+q$ and $-q$ are placed at points A and B respectively which are a distance $2L$ apart, C is the midpoint between A and B. The work done in moving a charge $+Q$ along the semicircle CRD is

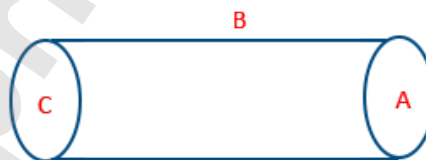


- A) $\frac{qQ}{2\pi\epsilon_0 L}$ B) $\frac{qQ}{6\pi\epsilon_0 L}$
C) $-\frac{qQ}{6\pi\epsilon_0 L}$ D) $\frac{qQ}{4\pi\epsilon_0 L}$

40. What happens when a glass rod is rubbed with silk?

- A) Gains protons from silk B) Gains electrons from silk
C) Gives electrons to silk D) Gives protons to silk

41. A hollow cylinder has a charge q coulomb within it. If f is the electric flux in units of voltmeter associated with the curved surface B, the flux linked with the plane surface A in units of V-m will be



- A) $\frac{q}{2\epsilon_0}$ B) $\frac{\phi}{3}$
C) $\frac{q}{\epsilon_0} - \phi$ D) $\frac{1}{2} \left(\frac{q}{\epsilon_0} - \phi \right)$

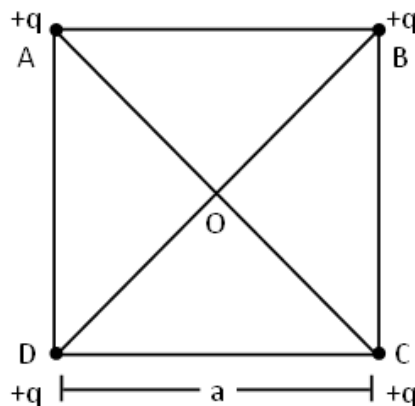
42. Total electric flux coming out of a unit positive charge put in air is

- A) ϵ_0 B) ϵ_0^{-1}
C) $(4\pi\epsilon_0)^{-1}$ D) $4\pi\epsilon_0$

43. What is the total charge in coulomb of 75.0 kg of electrons?

- A) $0.32 \times 10^{13} \text{ C}$ B) $3.2 \times 10^{16} \text{ C}$
C) $-1.32 \times 10^{13} \text{ C}$ D) $+1.32 \times 10^{-13} \text{ C}$

44. Four charges $+q$, $+q$, $+q$, and $-q$ are respectively placed at the four corners (A, B, C, and D) of a square of side 'a' as shown in the given figure.



The magnitude of the electric field at the centre of square is

- A) $\frac{1}{4\pi\epsilon_0} \frac{4\sqrt{2}q}{a^2}$ B) $\frac{1}{4\pi\epsilon_0} \frac{4q}{a^2}$
C) $\frac{1}{4\pi\epsilon_0} \frac{3\sqrt{2}q}{a^2}$ D) $\frac{1}{4\pi\epsilon_0} \frac{2\sqrt{2}q}{a^2}$

45. In a certain charge distribution, all points having zero potential can be joined by a circle S. Points inside S have positive potential and points outside S have negative potential. A positive charge, which is free to move, is placed inside S

- A) It will remain in equilibrium
 B) It can move inside S, but it cannot cross S
 C) It must cross S at some time
 D) It may move, but will ultimately return to its starting point

(Chemistry)

46. An ideal solution was obtained by mixing methanol and ethanol. If the partial vapour pressure of methanol and ethanol are 2.619 kPa and 4.556 kPa respectively, the composition of vapour (in terms of mole fraction) will be

- A) 0.634 MeOH, 0.365 EtOH
 B) 0.365 MeOH, 0.635 EtOH
 C) 0.574 MeOH, 0.326 EtOH
 D) 0.173 MeOH, 0.827 EtOH.

47. Which of the following statements about azeotropic mixtures is correct?

- A) They have a single boiling point.
 B) They have no vapor pressure.
 C) They have no freezing point.
 D) They cannot be separated by distillation.

48. A solution that obeys Raoult's law is

- A) Non-ideal
 B) Colloid
 C) Ideal
 D) Saturated

49. Which of the following factors affects the vapor pressure of a liquid?

- A) Temperature
 B) Volume
 C) Mass
 D) Density

50. The molal elevation constant of water is $0.52 \text{ K kg mol}^{-1}$. The boiling point of 1.0 molal aqueous KCl solution (assuming complete dissociation of KCl), should be

- A) 98.96°C
 B) 100.52°C
 C) 101.04°C
 D) 107.01°C

51. After adding a solute freezing point of solution decreases to -0.186 . Calculate ΔT_b if $K_f = 1.86$ and $K_b = 0.521$.

- A) 0.521
 B) 0.0521
 C) 1.86
 D) 0.0186

52. Which of the following factors does not affect the solubility of solid and liquid solutes in a solvent?

- A) Temperature
 B) Pressure
 C) The nature of the solute and the solvent
 D) The amount of the solute present in the solvent

53. Which of the following liquid pairs shows a positive deviation from Raoult's law?

- A) Water – hydrochloric acid
 B) Benzene – methanol
 C) Water – nitric acid
 D) Acetone – chloroform

54. If the boiling point of ethanol (mol. wt = 46) is 78°C , what is the boiling point of diethyl ether (mol. wt = 74)?

- A) 100°C
 B) 78°C
 C) 86°C
 D) 34°C

55. The relative lowering of vapour pressure of aqueous solution containing a non-volatile solute is 0.0125. The molality of the solution is

- A) 0.70
 B) 0.50
 C) 0.80
 D) 0.40

56. Which of the following statements about the ebullioscopic constant (K_b) is correct?

- A) It is independent of the nature of the solvent
 B) It is inversely proportional to the molarity of the solution
 C) It varies with temperature
 D) It is expressed in units of mol/L

57. The value of osmotic pressure of a 0.2 M aqueous solution at 293K is

- A) 8.4 atm
 B) 0.48atm
 C) 4.8 atm
 D) 4.0 atm

58. Ethylene glycol is used as an antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water prevent it from freezing at -6°C will be (K_f for water = $1.86 \text{ K kg mol}^{-1}$ and molar mass of ethylene glycol = 62 g mol^{-1})

- A) 804.32 g
 B) 204.30 g
 C) 400.00 g
 D) 304.60 g

59. Select the incorrect statement.

- A) A eutectic is a mixture that freezes and melts without change of composition
 B) A regular solution is one in which the entropy of mixing, but not the enthalpy of mixing, is the same as for an ideal solution
 C) Both of the above
 D) None of the above

60. Two solutions of a substance (non-electrolyte) are mixed in the following manner.

480 mL of 1.5 M first solution + 520 mL of 1.2 M second solution.

What is the molarity of the final mixture ?

- A) 2.70 M
 B) 1.34 M
 C) 1.50 M
 D) 1.20 M

61. 0.33 g of NaOH is added in water to make a 6 L solution at 277 K. The concentration of NaOH, when expressed in ppm is

- A) 3.3×10^{-5}
 B) 5.5×10^{-5}
 C) 6.3×10^{-4}
 D) 8.5×10^{-4}

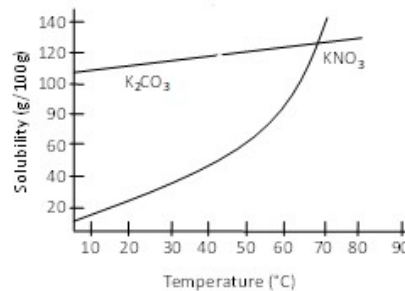
62. Mole fraction of glycine molecule in 0.140 molal aqueous solution is

- A) 1.4×10^{-1}
 B) 8.6×10^{-1}
 C) 2.51×10^{-3}
 D) 9.9749×10^{-1}

63. At temperature 327°C and concentration C osmotic pressure of a solution is P , the same solutions at concentration $C/2$ and a temperature 427°C shows osmotic pressure 2 atm ,
 A) $\frac{12}{7}$ B) $\frac{24}{7}$
 C) $\frac{6}{5}$ D) $\frac{5}{6}$
64. Addition of common salt to a sample of water will
 A) Increase its freezing point and boiling point both B) Decrease its freezing point and increase the boiling point
 C) Increase its freezing point and decrease the boiling point D) Decrease both the boiling and the freezing points
65. Henry's law relates the solubility of a gas in a liquid to:
 A) The pressure of the gas above the liquid B) The temperature of the liquid
 C) The volume of the gas D) The concentration of the solute
66. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature, 37°C . Hence, molarity of an intravenous glucose solution be to have the same osmotic pressure as blood is
 A) 0.30 M B) 0.20 M
 C) 0.10 M D) 0.50 M
67. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0125 . The molality of the solution is
 A) 0.70 B) 0.50
 C) 0.60 D) 0.80
68. A molar solution of sodium chloride has a density of 1.21 g mL^{-1} . The molarity of this solution is
 A) 3.15 B) 1.143
 C) 2.95 D) 4.15
69. Dry air was passed successively through a solution of 5 gm of a solute in 80 gm of water and then through pure water. The loss in weight of solution was 2.50 gm and that of pure solvent 0.04 gm . What is the molecular weight of the solute
 A) 70.31 B) 7.143
 C) 714.3 D) 80
70. Choose the correct statement.
 When concentration of a salt solution is increased
 A) Boiling point increases while vapour pressure decreases. B) Boiling point decreases while vapour pressure increases.
 C) Freezing point decreases while vapour pressure increases. D) Freezing point increases while vapour pressure decreases.
71. A solution containing 10 g per dm^3 of urea (molecular mass = 60 g mol^{-1}) is isotonic with a 5% solution of a non-volatile solute. The molecular mass of this non volatile solute is
 A) 300 g mol^{-1} B) 350 g mol^{-1}
 C) 200 g mol^{-1} D) 250 g mol^{-1}
72. Which of the following solution would exhibit abnormal colligative properties?
 A) 1 M glucose B) 0.1 M NaCl
 C) 0.1 M sucrose D) 10 gram glass powder in water
73. Vapour pressure of CCl_4 at 25°C is 143 mm Hg . 0.5 gm of a non-volatile solute (Mol. Wt. 65) is dissolved in 100 ml CCl_4 . Find the vapour pressure of the solution. (Density of $\text{CCl}_4 = 1.58\text{ g/m}^3$).
 A) 141.93 mm B) 94.39 mm
 C) 199.34 mm D) 143.99 mm .
74. What is the molality of a solution containing 80 grams of solute dissolved in 500 grams of solvent?
 A) 0.16 m B) 0.2 m
 C) 1.6 m D) 2 m
75. At equilibrium the rate of dissolution of a solid solute in a volatile liquid solvent is
 A) Less than the rate of crystallisation B) Greater than the rate of crystallisation
 C) Equal to the rate of crystallisation D) Zero
76. Which of the following statements is true regarding RLVP?
 A) RLVP is always positive B) RLVP is always negative
 C) RLVP can be positive or negative depending on the nature of solute and solvent D) RLVP is independent of temperature
77. Equimolar solution in the same solvent have
 A) same boiling point but different freezing point B) Same freezing point but different boiling point
 C) Same boiling and same freezing points D) Different boiling and different freezing points.
78. The osmotic pressure of urea solution is 500 mm of Hg at 10°C . If the solution is diluted and temperature is raised to 25°C , the osmotic pressure decreases to 105.3 mm of Hg , what is the extent of dilution?
 A) 10 times B) 2.5 times
 C) 5 times D) 7.5 times
79. Elevation in boiling point is:
 A) Proportional to the molarity of the solution B) Inversely proportional to the temperature
 C) Independent of the nature of the solute D) Dependent on the nature of the solvent
80. Boiling point of chloroform was raised by 0.323 K , when 0.5143 g of anthracene was dissolved in 35 g of chloroform. Molecular mass of anthracene is (K_b for $\text{CHCl}_3 = 3.9\text{ kg mol}^{-1}$)
 A) 79.42 g/mol B) 132.32 g/mol
 C) 177.42 g/mol D) 242.32 g/mol
81. Nitrobenzene freezes at 278.98°C . 0.25 molal solution of a solute in nitrobenzene causes freezing point depression of 2°C . K_f for nitrobenzene is
 A) 2 Km^{-1} B) 4 Km^{-1}
 C) 8 Km^{-1} D) 12 Km^{-1}

82. The amount of solute (molar mass $60 \text{ g} \cdot \text{mol}^{-1}$) that must be added to 180g of water so that the vapour pressure of water is lowered by 10% is
 A) 30g B) 60g
 C) 120g D) 12g
83. Molal depression constant for water is $1.86 \text{ K} \cdot \text{kg}^{-1} \cdot \text{m}^{-1}$. The freezing point of a 0.05 molal solution of a non-electrolyte in water is
 A) -1.86°C B) -0.93°C
 C) -0.093°C D) 0.93°C .
84. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M HNO_3 ? The concentrated acid is 70% HNO_3 .
 A) 70.0 g conc. HNO_3 B) 54.0 g conc. HNO_3
 C) 45.0 g conc. HNO_3 D) 90.0 g conc. HNO_3
85. What is the formula for the elevation in boiling point (ΔT_b)?
 A) $\Delta T_b = K_b \times m$ B) $\Delta T_b = K_b / m$
 C) $\Delta T_b = m / K_b$ D) $\Delta T_b = K_b - m$
86. Which of the following colligative properties can provide molar mass of proteins (or polymers or colloids) with greatest precision?
 A) Osmotic pressure B) Elevation of boiling point
 C) Depression of freezing point D) Relative lowering of vapour pressure

87. The solubility of various substances increases with the increase in temperature. The variation in the solubilities of K_2CO_3 and KNO_3 in water with temperature is represented in the given graph.

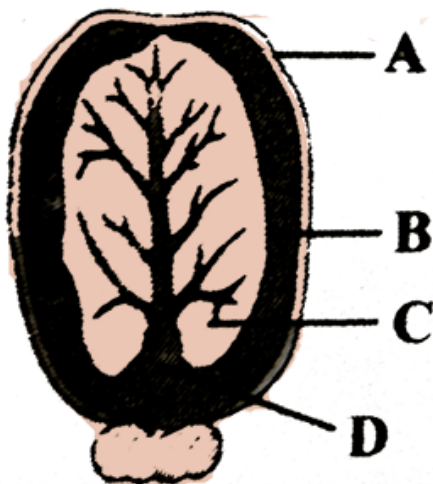


In the solubility curve of K_2CO_3 , the approximate amount of K_2CO_3 dissolved in 1kg of water at 50°C will be between

- A) 900 g to 1000 g B) 1000 g to 1100 g
 C) 1200 g to 1300 g D) 1400 g to 1500 g
88. The freezing point of a solution is:
 A) Lower than that of the pure solvent B) Higher than that of the pure solvent
 C) Unaffected by the presence of a solute D) Dependent on the pressure applied
89. What happens to the solubility of a gas in a liquid as the temperature of the liquid increases?
 A) Increases B) Decreases
 C) Remains constant D) Depends on the nature of the gas
90. The molal elevation constant is the ratio of the elevation in boiling point to
 A) Molarity B) Molality
 C) Mole fraction of solute D) Mole fraction of solvent

(Botany)

91. The most exceptional feature of zoophilous flower is
 A) scented, having nectar and most colourful B) scented, having nectar but inconspicuous
 C) present of only perianth D) without colour and show
92. Identify the parts labelled as A, B, C and D in the given figure and select the correct option from the codes given below.



- A) A-Seed coat B-Scutellum C-Epicotyl D-Kypocotyl
 B) A-Seed coat B-Scutellum C-Hypocotyl D-Epicotyl
 C) A-Seed coat B-Cotyledon C-Endosperm D-Hypocotyl
 D) A-Seed coat B-Endosperm C-Cotyledon D-Hypocotyl
93. In the seeds of dicots, the portion of embryonal axis, which lies above the level of cotyledons, is known as
 A) Epicotyls B) Scutellum
 C) Hypocotyls D) Coleorrhiza
94. A dicotyledonous plant bears flowers but never produces fruits and seeds. The most probable cause for the above situation is
 A) plant is dioecious and bears only pistillate flowers B) plant is dioecious and bears only staminate flowers
 C) plant is monoecious D) plant is diecious and bears only staminate flowers
95. Which of the following pair have haploid structures
 A) nucellus and antipodal cells B) antipodal cells and egg cell

- C) antipodal cells and megaspore mother cell D) nucellus and primary endosperm nucleus
96. In embryophytes, sporogenesis involves
 A) microsporogenesis and megasporogenesis B) formation of diploid spores
 C) formation of haploid spores D) formation of mitospores
97. The chemical nature of the compound forming exine is
 A) lipids and proteins B) suberin and fats
 C) CaCO_3 D) polysaccharide
98. is favoured by heterostyly in *Primula*
 A) Autogamy B) Allogamy
 C) Homogamy D) All of these
99. A primitive massive nucellus occurs in some ovules. The condition is called
 A) crassinucellate B) tenuinucellate
 C) resupinate ovule D) protonucellate
100. Find out the correct statement
 A) The plant *Strobilanthes kunthiana* flower only once every year B) Monkeys and apes show cyclical changes during reproduction, called oestrous cycle
 C) Bamboo species flower only once in their life time D) All of the above
101. Meiotic division in an ovule takes place in
 A) nucellus B) megaspore mother cell
 C) megaspore D) archesporium
102. Total number of meiotic divisions required for forming 100 zygotes/100 grains of wheat is
 A) 100 B) 75
 C) 125 D) 50
103. Wrongly matched set is
 A) microspore - pollen B) megasporangium - ovule
 C) microsporangium - anther lobes D) None of the above
104. If these hybrids are made into apomicts, there is no segregation of characters in the hybrid progeny.
 A) False B) True
105. Sexual reproduction was discovered in plants by
 A) Camerarius B) Amici
 C) Strasburger D) Nawaschin
106. Pollination by snail and slug is known as
 A) entomophilous B) ornithophilous
 C) anemophilous D) malacophilous

107. Which of the following are incorrect about pollen grains ?
 (i) Pollen grains develop inside the microsporangia.
 (ii) Pollen grains represent the male gametophytic generation.
 (iii) The pollen grains have a two-layered wall: the outer intine and inner exine.
 (iv) The intine is made up of sporopollenin and has germ pores.
 (v) Pollen grains are always two-celled at the time of shedding.
 A) (ii) and (iii) B) (ii),(iii) and (iv)
 C) (iii), (iv) and (v) D) (i) and (iii)
108. Which of the following plants commonly exhibits polyembryony?
 A) Wheat B) Rice
 C) Citrus D) Maize
109. Which one of the following would not lead to formation of clones?
 A) Double fertilization B) Apomixis
 C) Vegetative reproduction D) Tissue culture
110. In monocots, the most common pollen tetrad is
 A) isobilateral B) tetrahedral
 C) linear D) T- shaped or decussate
111. Coconut water from a tender coconut is
 A) innermost layers of the seed coat B) degenerated nucellus
 C) immature embryo D) free nuclear endosperm
112. An organic substance that can withstand environmental extremes and cannot be degraded by any enzyme is
 A) cuticle B) sporopollenin
 C) lignin D) cellulose
113. Pappus is present in Composite for
 A) air pollination B) insect pollination
 C) water pollination D) air dispersal
114. In angiosperms, normally after fertilization
 A) the zygote divides earlier than the primary endosperm nucleus B) the primary endosperm nucleus divides earlier than the zygote
 C) both the zygote and primary endosperm nuclei divide D) both the zygote and primary endosperm nuclei undergo a resting period
115. Mosaic endosperm was first reported in
 A) *Pheonix* B) *Zea*
 C) *Myristica* D) *Annona*
116. The central cell after triple fusion become the
 A) PEC (primary endosperm cell) B) PEN (primary endosperm nucleus)
 C) Diploid D) PEC and develops into embryo
117. Which of the following plant products is the hardest?
 A) Lignin B) Cutin
 C) Suberin D) Sporopollenin

118. A normal plant suddenly started reproducing parthenogenetically. The number of chromosomes of the second generation as compared to the parent will be
 A) One half B) One fourth
 C) Same D) Double
119. After penetrating stigmatic and stylar tissue, the pollen tube usually grows downwards towards egg because
 A) no other path to follow B) it grows under the control of egg nucleus
 C) attracted by dissimilar electric charge D) the filiform apparatus of synergids is believed to attract the pollen tube
120. In tape grass (*Vallisneria*)
 A) both male and female flowers break from the plant and float on the surface of water B) only the female flowers break from the plant, while the male flowers are brought to the surface by long stalks
 C) only the male flowers break from the plant and rise to the surface, while the female flowers are brought to the surface by long pedicles D) any of the two types of flowers can break
121. Adventitious polyembryony occurs when:
 A) Multiple embryos develop from the nucellus tissue B) Multiple embryos develop from the seed coat
 C) Multiple embryos develop from the pollen grains D) Multiple embryos develop from the ovule integuments
122. During microsporogenesis, meiosis occurs in
 A) endothecium B) microspore mother cells
 C) microspore tetrads D) pollen grains
123. From the statements given below choose the option that are true for a typical female gametophyte of a flowering plant
 (i) It is 8-nucleate and 7-celled at maturity.
 (ii) It is free-nuclear during the development.
 (iii) It is situated inside the integument but outside the nucellus.
 (iv) It has an egg apparatus situated at the chalazal end.
 A) (i) and (iv) B) (ii) and (iii)
 C) (i) and (ii) D) (ii) and (iv)
124. This is an example of a very old viable seed excavated from Arctic Tundra. The seed germinated and flowered after an estimated record of 10,000 years of dormancy. It is
 A) *Victoria* B) *Lupinus arcticus*
 C) *Phoenix dactylifera* D) *Strobilanthes kunthiana*
125. Callase enzyme which dissolves callose of pollen tetrads to separate four pollens is provided by
 A) pollens B) tapetum
 C) middle layers D) endothecium
126. Even in absence of pollinating agents seed setting is assured in
 A) *Zostera* B) *Salvia*
 C) Fig D) *Commelina*
127. Father of Indian embryology is
 A) P. Maheshwari B) Swaminathan
 C) R. Misra D) Butler
128. Milky water of tender coconut is
 A) Liquid gametes B) Liquid nucellus
 C) Liquid female gametophyte D) Liquid endosperm
129. Ubisch bodies are secreted by
 A) Tapetum B) Exine
 C) Microspore mother cells D) Endothecium
130. The aleurone layer of endosperm in monocot seed is related to
 A) growth of endosperm B) digestion of reserve food of embryo
 C) store food of endosperm D) formation of endosperm
131. The portion of embryonal axis between plumule (future shoot) and cotyledons is called
 A) hypocotyl B) epicotyl
 C) coleorhiza D) coleoptile
132. Perisperm differs from endosperm in
 A) being a diploid tissue B) its formation by fusion of secondary nucleus with several sperms
 C) being a haploid tissue D) having no reserve food
133. Female gametophyte of a typical dicot at the time of fertilization is
 A) 8-celled B) 7-celled
 C) 6-celled D) 5-celled
134. For good growth of pollen tube, necessary element is
 A) Ca B) B
 C) Mg D) Mo
135. The orchid flowers emit a chemical that resembles the odour produced by the female wasps for sexual attraction. The chemical is
 A) pheromone B) kinetin
 C) florigen D) cytokinin

(Zoology)

136. During the process of ____ i ____ the fusion of the sperm and the egg takes place in the ____ ii ____ . The information in which alternative completes the given statement?
 A) i- fertilization ii- uterus B) i- implantation ii- oviduct
 C) i- implantation ii- uterus D) i- fertilization ii- oviduct

137. Preparation of Fallopian tube for conveying developing embryo to uterus is aided by which of the following hormone

- A) human placental lactogen
B) oxytocin
C) progesterone
D) prolactin

138. Given below are the three statements each with two blanks. Select the option which correctly fills up the blank in any two statements.

A) Each seminiferous tubule is lined on its inside by two types of cells called (i) and (ii)

B) The seminiferous tubules open into the (i) through (ii).

C) The enlarged end of penis called the (i) is covered by a loose fold of skin called the (ii).

- A) (B)-(i) vas deferens, (ii) urethral meatus (A)-(i) spermatogonia, (ii) follicular cells
B) (C)-(i) glans penis, (ii) foreskin (B)-(i) vasa efferentia, (ii) rete testis
C) (A)-(i) spermatogonia, (ii) sertoli cells (C)-(i) urethral meatus, (ii) scrotum
D) (A)-(1) spermatocytes, (ii) oogonia (B)-(i) rete testis, (ii) vasa efferentia

139. The mammalian corpus luteum produces

- A) Estrogen
B) Progesterone
C) Luteotropic hormone
D) Luteinizing hormone

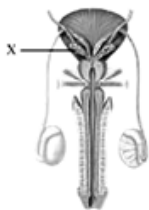
140. At menopause there is rise in urinary excretion of

- A) FSH
B) STH
C) MSH
D) none of these

141. Gastrulation comprises

- A) morphogenetic movements
B) differentiation of archenteron
C) differentiation of three germ layers
D) All of the above

142. The given diagram illustrates male reproductive



system.

The structure labelled X in the given diagram represents

- A) Prostate
B) Epididymis
C) Vase different
D) Seminal vesicles

143. Both corpus luteum and macula lutea are

- A) found in human ovaries
B) a source of hormones
C) characterised by a yellow colour
D) contributory in maintaining pregnancy

144. Refer to the given graph representing interplay of different hormones (A-D) during menstrual cycle in women and answer the question that follow.



Which hormone (A, B, C or D) is necessary for the final follicular growth and ovulation?

- A) A
B) B
C) C
D) D

145. In case of non-fertilisation, corpus luteum

- A) stops secreting progesterone
B) changes to corpus albicans
C) starts producing progesterone
D) None of the above

146. Match the following columns.

	Column I		Column-II
A.	Miscarriage	1.	Premature degeneration of corpus luteum
B.	Pregnancy test	2.	Animal pole
C.	Luteal phase	3.	Progesterone secretion
D.	Polar bodies	4.	hCG

- A) A B C D
1 3 2 4

- B) A B C D
1 4 3 2

- C) A B C D
3 2 4 1

- D) A B C D
2 1 4 3

147. Progesterone level falls during

- A) gestation
B) parturition
C) lactation
D) menstruation

148. Sugars that sperm use for energy is secreted by

- A) Prostate gland
B) Seminal vesicle
C) Vasa efferentia
D) Epididymis

149. If a pregnant woman having prolonged labour pains then, to aid parturition, it is advisable to administer a hormone that can

- A) activate the smooth muscles
B) increase the metabolic rate
C) tightens the pelvic ligament
D) stimulate the ovary

150. Which of the following is/are the first most common sign of pregnancy?

- I. Amenorrhea
II. Quickening
III. Ballotement of foetus
IV. Foetal movement perceived by examiner

- A) I, II, III and IV
B) I and IV
C) Only I
D) II and III

151. The sperm and the egg make different contributions to zygote. Which of the following statements about their contributions are true?

- (i) Sperm contributes most of the mitochondria.
(ii) Egg contributes most of the cytoplasm.
(iii) Both sperm and egg contribute haploid nucleus.
(iv) Both sperm and egg contribute centrioles.

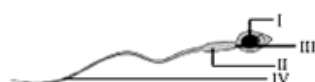
- A) (i) and (ii)
B) (ii) and (iii)
C) (iii) and (iv)
D) (i), (ii), (iii) and (iv)

152. In a normal pregnant woman, the amount of total gonadotropin activity was assessed. The result expected was

- A) high level of circulating FSH and LH in the uterus to stimulate implantation of the embryo
B) high level of circulating hCG to stimulate endometrial thickening
C) high levels of FSH and LH in uterus to stimulate endometrial thickening
D) high level of circulating hCG to stimulate

estrogen and
progesterone synthesis

- 153.** The correct sequence of spermatogenic stages leading to the formation of sperms in a mature human testis is
- A) spermatogonia-spermatocyte-spermatid-sperms B) spermatid-spermatocyte-spermatogonia-sperms
- C) spermatogonia-spermatid-spermatocyte-sperms D) spermatocyte-spermatogonia-spermatid-sperms
- 154.** Follicular phase of menstrual cycle is the other name of
- A) proliferative phase B) secretory phase
- C) luteal phase D) menstruation
- 155.** The number of sperms produced at the end of the second meiotic division is
- A) 4 B) 3
- C) 2 D) 1
- 156.** The permissible use of the technique amniocentesis is for
- A) Detecting sex of the unborn foetus B) Artificial insemination
- C) Aransfer of embryo into the uterus of a surrogate mother D) Detecting any genetic abnormality
- 157.** Which hormone is secreted in a women if pregnancy has occurred?
- A) Oestrogen B) Progesterone
- C) Luteinising hormone D) Chorionic gonadotropin
- 158.** The distal centriole gives attachment to the axial filament, but the proximal centriole helps in
- A) swimming B) cleavage of fertilised egg
- C) provides energy D) helps distal centriole
- 159.** The given figure illustrates a sperm cell.



Which part of sperm cell helps in the production of ATP?

- A) I B) II
- C) III D) IV
- 160.** Before fertilisation, nuclei of a particular cell fuse and form a diploid nucleus called secondary nucleus. The cell is
- A) antipodal cell B) central cell
- C) egg cell D) synergid cell
- 161.** Corpus luteum releases
- A) Oestrogen B) Progesterone
- C) Both (A) and (B) D) Androgen
- 162.** Onset of menstruation of human female is called :
- A) Menopause B) Puberty
- C) Gestation D) Menarche
- 163.** The number of autosomes in human primary spermatocyte is
- A) 46 B) 44

C) 23 D) 22

- 164.** The fusion of male and female pronuclei of the gametes is called
- A) fertilisation B) conjugation
- C) amphimixis D) panmixis
- 165.** Fertilised ovum is transplanted is uterus after
- A) 1 day B) 7 days
- C) 8 days D) 10 days
- 166.** In human beings, which part shows the minimum increase in weight from birth to adulthood?
- A) Muscles B) Skeleton
- C) Fat D) Brain
- 167.** In ovary we can find (i) Primary follicle (ii) Graafian follicle (iii) Blood vessel (iv) Corpus luteum
- A) (i) and (ii) B) (ii), (iii) and (iv)
- C) (iii) and (iv) D) (i), (ii), (iii) and (iv)
- 168.** In an experiment, sperms removed from epididymis of a man were added in a dish containing appropriate media and oocyte. No fertilization was seen. However, when sperms from epididymis were directly placed in uterus of an ovulated woman, she became pregnant. These observations suggest that
- A) the sperms need to travel some distance to attain fertilizing ability B) the oocyte secretes some biochemicals or factors which help sperms to fertilize
- C) the hormones in the body help sperms to attain fertilizing ability D) the contents of female reproductive tract interact with sperms and activate them for fertilization
- 169.** Graafian follicle can be traced in
- A) testes B) ovaries
- C) stomach D) spleen
- 170.** Column I contains terms and column II contains definitions. Match them correctly and select the right answer.

Column I	Column II
A. Parturition	1. Attachment of zygote to endometrium
B. Gestation	2. Release of egg from Graafian follicle
C. Ovulation	3. Delivery of baby from uterus
D. Implantation	4. Duration between pregnancy and birth
E. Conception	5. Formation of zygote by fusion of the egg and sperm
	6. Stoppage of ovulation and menstruation

- A) A - 2, B - 4, C - 1, D - 5, E - 3 B) A - 4, B - 3, C - 1, D - 5, E - 2
- C) A - 5, B - 1, C - 2, D - 3, E - 4 D) A - 3, B - 4, C - 2, D - 1, E - 5
- 171.** Which is correctly matched in a normal menstrual cycle ?
- A) Endometrium regenerates —5 to 10 days B) Release of egg —5th day

- C)** Endometrium secretes nutrients for implantation —11 to 18 days
- D)** Rise in progesterone level —1 to 15 days
- 172.** In human beings, the eggs are
- A)** mesolecithal **B)** alecithal
- C)** microlecithal **D)** macrolecithal
- 173.** Which one of the following statements about human sperm is correct?
- A)** acrosome has a conical pointed structure used for piercing and penetrating the egg, resulting in fertilisation
- B)** the sperm lysins in the acrosome dissolve the egg envelope facilitating fertilisation
- C)** acrosome serves as a sensory structure leading the sperm towards the ovum
- D)** acrosome serves no particular function
- 174.** Identify the correct statement from the following.
- A)** High levels of estrogen triggers the ovulatory surge.
- B)** Oogonial cells start to proliferate and give rise to functional ova in regular cycles from puberty onwards.
- C)** Sperms released from seminiferous tubules are highly motile.
- D)** Progesterone level is high during the post ovulatory phase of menstrual cycle.

- 175.** Which one of the following is the most widely accepted method of contraception in India, at present?
- A)** Tubectomy **B)** Diaphragm
- C)** IUDs (Intra Uterine Devices) **D)** Cervical caps
- 176.** Energy for sperm motility is provided by
- A)** Head **B)** Tail
- C)** Neck **D)** Middle piece
- 177.** In oogenesis haploid egg is fertilized by sperm at which stage?
- A)** Primary oocyte **B)** Secondary oocyte
- C)** Oogonium **D)** Ovum
- 178.** Breast and sex glands develop as a result of the secretions of which structure?
- A)** Adrenal gland **B)** Thyroid gland
- C)** Anterior pituitary **D)** Posterior pituitary
- 179.** What is the total number of polar bodies formed during oogenesis in the ovary?
- A)** 4 **B)** 3
- C)** 1 **D)** 2
- 180.** Corpus luteum secretes
- A)** progesterone **B)** oestrogen
- C)** luteinizing hormone **D)** follicle stimulating hormone

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