



Guidelines:

In every subject:

- (a) In section-A, 35 questions will be given. Answer all 35 questions from Section-A
(b) In section-B, 15 questions will be given. Out of which answer 10 questions only.

SECTION A

01. During gamete formation recombinase enzyme is required at which phase

- 1) Zygotene
- 2) Pachytene
- 3) Diakinesis
- 4) Diplotene

02. Meiotic divisions in an angio-spermic plant can be observed by examining cells of

- 1) The apical meristem of the stem
- 2) The apical dividing cells in the root tip
- 3) Cells of the vascular cambium when they are dividing
- 4) Pollen mother cells when they are undergoing divisions in the anther

03. Meiosis involves

- 1) Two cycles of DNA replication
- 2) Single cycle of DNA replication
- 3) Cyto kinesis only after meiosis – II
- 4) Centro mere division in Anaphase – I

04. Which of the following are the key features of meiosis

- 1) Two sequential cycles of nuclear and cell division
- 2) Initiated after the replication of parental chromosomes
- 3) Involves pairing of homologous chromosomes
- 4) All

05. Which of the following ensures the production of haploid phase in sexually reproducing organisms

- 1) Fertilization

2) Mitosis

3) Meiosis

4) Amitosis

06. The beginning of diplotene is recognized by

- 1) Formation of Bivalents
- 2) Terminalization of chiasmata
- 3) Appearance of recombination nodule
- 4) Dissolution of synaptonemal complex

07. A chromosome at Telophase – I contains

- 1) Single chromatid
- 2) Two chromatids
- 3) Single DNA molecules
- 4) 4 Chromatids

08. Bivalents clearly appear as tetrads in

- 1) Leptotene
- 2) Zygotene
- 3) Pachytene
- 4) Late anaphase – I

09. Incorrect statement among the following w.r.t. Meiosis

- 1) Four haploid daughter cells are formed at the end of meiosis – II
- 2) Daughter cells contain same number of chromosomes
- 3) Chromosome duplication occur in S-phase
- 4) Homologous chromosomes move to opposite poles with both their chromatids at Anaphase – II

10. Statement I : Root system develops from radical part of embryo

Statement II : Secondary roots are exogenous in origin

- 1) Statement-I correct Statement II wrong
- 2) Statement-I wrong , Statement-II correct
- 3) Both Statements are correct
- 4) Both Statements are wrong

11. Which of the following part is generally green when young and later becomes woody and dark brown?
- 1) Stem
 - 2) Seed
 - 3) Leaf
 - 4) Flower
12. Terminal bud is absent at
- 1) Tip of stem
 - 2) Tip of branches of stem
 - 3) Tip of tap root and its branches
 - 4) 2 & 3
13. Which of the following are usually absent in root system
- 1) Buds and leaves
 - 2) Nodes
 - 3) Internodes
 - 4) All
14. Homologous chromosomes separate and move towards opposite poles during
- 1) Anaphase – I
 - 2) Anaphase – II
 - 3) Leptotene
 - 4) Pachytene
15. No. of chromosomes become half in
- 1) Anaphase - I
 - 2) Anaphase - II
 - 3) Telophase - I
 - 4) Telophase - II
16. What will be the amount of DNA in G1 if each product of meocyte contains 30pg DNA at the end of Meosis - II ?
- 1) 30 pg
 - 2) 60 pg
 - 3) 15 pg
 - 4) 120 pg
17. The recombination nodules appear at
- 1) Zygotene
 - 2) Meiosis – II
 - 3) Pachytene
 - 4) Diplotene
18. The complex formed by a pair of synapsed homologous chromosomes is called
- 1) Bivalent
 - 2) Equatorial plate

- 3) Chiasma
- 4) Recombination nodule

19. Meiosis-II involves

- 1) Synthesis of DNA
- 2) Separation of sex chromosomes
- 3) Exchange of chromatids
- 4) Separation of chromatids

20. Statement -1: In oocytes of some vertebrates, diplotene can last for months or years

Statement-2 : Diakinesis represents transition to metaphase

- 1) Statement-I correct Statement II wrong
- 2) Statement-I wrong , Statement-II correct
- 3) Both Statements are correct
- 4) Both Statements are wrong

21. The stage between the two meiotic divisions is called

- 1) Inter phase
- 2) Inter kinesis
- 3) Cytokinesis
- 4) M – phase

22. Match the following column

COLUMN - I	COLUMN - II
i) Nucleolus disappear	A) Anaphase - II
ii) Disjunction	B) Diakinesis
iii) Chromosome compaction	C) Leptotene
iv) Chromatid separation	D) Anaphase - I

	i	ii	iii	iv
1)	A	B	C	D
2)	B	A	C	D
3)	B	D	C	A
4)	C	D	A	B

23. If each cell of spore tetrad contains 12 chromosomes, how many pachytene tetrads are found in the meocyte of the plant

- 1) 2
- 2) 8
- 3) 12
- 4) 24

24. At what stage the meiotic spindle is assembled to prepare the homologous chromosomes for separation

- 1) Diplotene
- 2) Diakinesis
- 3) Metaphase – I
- 4) Zygotene

25. How many spindle apparatus are formed during meiosis – I in a meiocyte

- 1) One
- 2) Three
- 3) Two
- 4) 1 and 3

26. Which of the following description describes the cell shown in figure?



- 1) 8 chromosomes, 4 homologous pair
- 2) 8 chromosomes, 8 homologous pair
- 3) 16 chromosomes, 8 homologous pair
- 4) 16 chromosomes, 4 homologous pair

27. In meiosis - I, a bivalent is an association of

- 1) Four chromatids and One centromeres
- 2) Two chromatids and Four centromeres
- 3) Two chromatids and one centromere
- 4) Four chromatids and two centromeres

28. Crossing over that results in genetic recombination in higher organisms occurs between

- 1) Sister chromatids and bivalent
- 2) Non-sister chromatids of a bivalent
- 3) Two daughter nuclei
- 4) Two different bivalents

29. Meiocytes in flowering plants are

- 1) Gamete mother cell
- 2) Spore mother cell
- 3) Spores
- 4) Zygotes

30. Compared to Mitosis which phase of Meiosis – I is more complex and longest

- 1) prophase – I
- 2) metaphase – I
- 3) anaphase – I

4) telophase – I

31. During which stage of cell division, do the sister chromatids begin to move towards the poles?

- 1) Anaphase of mitosis
- 2) Telophase – I
- 3) Anaphase – II
- 4) 1 & 3

32. Meiosis in a plant occurs when there is a change

- 1) from gametophyte to sporophyte
- 2) from sporophyte to gametophyte
- 3) from gametophyte to gametophyte
- 4) from sporophyte to sporophyte

33. Chromosomes decondense and lose their individuality in

- 1) Prophase
- 2) Anaphase
- 3) Telophase
- 4) Interkinesis

34. How many chromosomes will the meiocyte have at G₁, S and Telophase -I nucleus respectively, if it has 14 chromosomes in its body cells?

- 1) 14, 14, 7
- 2) 14, 14, 28
- 3) 7, 7, 7
- 4) 7, 14, 14

35. Statement -1: Conservation of specific chromosome number of each species is achieved across generations through meiosis

Statement-2: Meiosis increases genetic variability in the population of organisms from one generation to next

- 1) Statement-I correct Statement II wrong
- 2) Statement-I wrong, Statement-II correct
- 3) Both Statements are correct
- 4) Both Statements are wrong

SECTION B

36. An anther has 1200 pollen grains. How many PMCs must have been there to produce them?

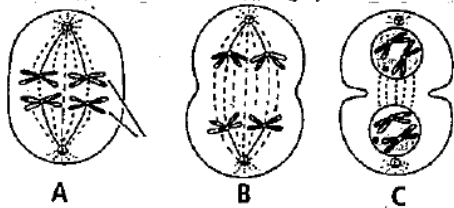
- 1) 1200
- 2) 300

- 3) 150
4) 2400

37. At the end of meiosis – I, chromosome number

- 1) is reduced to half
2) doubles up
3) remains the same
4) 2 or 3

38. Identify the given figures showing meiotic phases and select the correct option



	A	B	C
1)	Metaphase	Anaphase	Telophase
2)	Metaphase-I	Anaphase-I	Telophase-I
3)	Metaphase-II	Anaphase-II	Telophase-II
4)	Anaphase-I	Metaphase-I	Telophase-I

39. Synaptonemal complex is associated with

- 1) Mitotic chromosome
2) Meiotic chromosome
3) Amitotic chromosome
4) Both 1 & 2

40. Find the incorrect pair

- 1) Diplotene – Chiasmata appears as X-shaped
2) Pachytene – Exchange of genetic material between non-homologous chromosomes
3) Telophase-2 – Single chromatid per chromosome
4) Diakinesis – Chromosomes fully condensed

41. Meiosis occurs in organisms during

- 1) sexual reproduction
2) vegetative reproduction
3) both sexual and vegetative reproduction
4) none of these

42. Meiosis may occur in

- 1) Megaspore
2) Microspore
3) Gamete
4) Zygote

43. During meiosis – I in humans, daughter cell receives

- 1) only maternal chromosomes
2) a mixture of maternal and paternal chromosomes
3) same number of chromosomes as present in parent cell
4) none of these

44. Four different steps that occur during meiosis are given in the following list

- i) Complete separation of chromatids
ii) Pairing of homologous chromosomes
iii) Lining up of paired chromosomes on equator
iv) Crossing over between chromatids

Select the correct sequential arrangement of the steps

- 1) (ii), (iii), (iv), (i)
2) (iii), (ii), (iv), (i)
3) (ii), (iv), (iii), (i)
4) (iii), (i), (ii), (iv)

45. Statement-1: In Diakinesis, displacement of chiasmata towards terminal ends of the homologous chromosomes occurs.

Statement -2: Terminalization occurs in Diakinesis

- 1) Statement-I correct Statement II wrong
2) Statement-I wrong, Statement-II correct
3) Both Statements are correct
4) Both Statements are wrong

46. In which phases amount of DNA in a cell remains at 4C level if the initial amount is 2C

- 1) G₁
2) Only G₂
3) G₁ and S
4) G₂ and Prophase

47. The correct sequence of stages in prophase of Meiosis is

- 1) Leptotene, Pachytene, Zygotene, Diakinesis, Diplotene
2) Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis
3) Zygotene, Leptotene, Pachytene, Zygotene, Leptotene

4) Diplotene, Diakinesis, Pachytene, Zygotene, Leptotene

48. During meiosis centromere divides

- 1) Only once at anaphase II
- 2) Only once at anaphase I
- 3) Twice in meiosis I & II
- 4) Twice in anaphase I & II

49. Meiosis is significant because

- 1) It produces identical cells
- 2) It restores the original number of chromosomes (after fertilization)
- 3) There is doubling of DNA contents in the cell
- 4) It occurs only in vegetative cells

50. What is the chromosome number in each cell of dyad formed after meiosis-1 in Onion

- 1) 8
- 2) 16
- 3) 12
- 4) 7

**ZOOLOGY
SECTION A**

51. The presence of earthworm in the garden soil can be traced out by

- 1) Burrows
- 2) Moisture in soil
- 3) Both 1 & 2
- 4) Worm castings

52. Segment of Earthworm bearing mouth is

- 1) Prostomium
- 2) Peristomium
- 3) Clitellum
- 4) Pygidium

53. The clitellum of pheretima is present in segments

- 1) 12, 13 & 14
- 2) 13, 14 & 15
- 3) 15, 16 & 17
- 4) 14, 15 & 16

54. Identify the correct statement about earth worm

1) Earthworms are terrestrial Invertebrates that live in burrows during day time

2) Earth worms are aquatic annelids that live in moist soil

3) Earthworms *inhabit* the deepest layer of moist soil

4) Presence of earthworms traced by the presence of burrows in the soil

55. In correct feature of setae in earthworm

- 1) 'S' Shaped structure
- 2) embedded in epidermal pits in the middle of each segment
- 3) Help in locomotion
- 4) Made of collagen

56. Non cellular layer in the body wall of earth worm

- 1) Epidermis
- 2) Muscle layer
- 3) Parietal peritoneum
- 4) Cuticle

57. Match the following structures and their location in earth worm

A) Spermathecal apertures	I) Mid Ventral surface of 14 th segment
B) Female genital pore	II) Ventrolateral sides of 5-9 segments
C) Male genital pore	III) Ventrolateral side of 18 th segment
D) Pygidium	IV) Posterior surface of last segment

- | | A | B | C | D |
|-------|---|-----|-----|-----|
| 1) II | | I | III | IV |
| 2) IV | | II | I | III |
| 3) I | | III | II | IV |
| 4) II | | III | I | IV |

58. Paired apertures in preclitellar region of earth worm

- 1) Male genital pore
- 2) Nephridiopores
- 3) Spermathecal apertures
- 4) Dorsal pores

59. Rows of S-shaped setae in matured earth worm are absent in

- 1) First segment
 - 2) Last segment
 - 3) Clitellar region
 - 4) All the above
- 60. Which of the following part in pheretima increases the area of absorption**
- 1) Stomach
 - 2) Gizzard
 - 3) Intestinal caecum
 - 4) Typhlosole
- 61. The secretions of the calciferous glands in Pheretima neutralize the**
- 1) Hydrochloric acid
 - 2) Hyaluronic acid
 - 3) Humic acid
 - 4) All the above
- 62. Structure that are absent in 26th segment of earthworm**
- 1) Typhlosole
 - 2) Setae
 - 3) Intestinal caeca
 - 4) Calciferous glands
- 63. Match the following structures and their location**
- | | |
|-------------------|---|
| a) Buccal chamber | i) 4 th – segment |
| b) Oesophagus | ii) 1 st -3 rd segments |
| c) Pharynx | iii) 9 th -14 th segments |
| d) Stomach | iv) 8 th – 9 th segments |
| e) gizzard | v) 5 th – 7 th segments |
- | | A | B | C | D | E |
|----|-----|-----|----|-----|----|
| 1) | V | III | II | I | IV |
| 2) | II | V | I | III | IV |
| 3) | II | III | IV | I | V |
| 4) | III | II | I | IV | V |
- 64. Circulatory system in earth worm is**
- 1) Open type with hemoglobin in RBC's
 - 2) Open type with hemoglobin in plasma
 - 3) Closed type with hemoglobin in RBC's
 - 4) Closed type with hemoglobin in Plasma
- 65. The respiratory organ of pheretima is**
- 1) Moist body wall
 - 2) Nephridium
 - 3) Gills
 - 4) Trachea
- 66. Pharyngeal nephridia of Pheretima are in the segments**
- 1) 1, 3, 4
 - 2) 4, 5, 6
 - 3) 6, 7, 8
 - 4) 5, 6, 7
- 67. Which of the following are enteronephric nephridia in pheretima**
- 1) Integumentary only
 - 2) Septal & integumentary
 - 3) Pharyngeal & Septal
 - 4) Integumentary & Pharyngeal
- 68. Forest of nephridia are not**
- 1) Present in clitellar segments
 - 2) Closed and exonephric nephridia
 - 3) Attached to Inner body wall
 - 4) Opening into alimentary canal
- 69. Nephridia are present in all segments of the earthworm except**
- 1) First 2 – segments
 - 2) First 3- segments
 - 3) Last segments
 - 4) First & last segment
- 70. Most numerous nephridia in earthworm are**
- 1) Septal nephridia
 - 2) Pharyngeal
 - 3) Integumentary
 - 4) Tufted nephridia
- 71. Open and enteronephric nephridia are**
- 1) Pharyngeal
 - 2) Integumentary nephridia
 - 3) Tufted nephridia
 - 4) Septal nephridia
- 72. Earth worms are mainly**
- 1) Ammonotelic
 - 2) Ureotelic
 - 3) Uricotelic
 - 4) aminotelic
- 73. Which part of nervous system is located on dorsal side in earthworm**
- 1) Cerebral ganglia
 - 2) Nerve cords
 - 3) Segmental ganglia
 - 4) Segmental nerves

74. **Nerve ring of earthworm is formed encircling**
 1) Oesophagus
 2) Buccal cavity
 3) Pharynx
 4) Stomach
75. **Earthworms have no special sense organs still they are sensitive to**
 1) Light and sound
 2) touch and sound
 3) Touch, taste and sound
 4) Touch, taste and light
76. **The nephridia that open into gut are**
 1) Septal, Integumentary
 2) Pharyngeal, septal
 3) Pharyngeal, Integumentary
 4) all
77. **Closed and enteronephric nephridia are located in**
 1) 3, 4, 5
 2) 4, 5, 6
 3) 1, 2, 3
 4) 14, 15, 16
78. **The nerve cord of earthworm is**
 1) Single nerve cord
 2) single ventral nerve cord
 3) Double ventral nerve cord
 4) double dorsal nerve cord
79. **Statement-I : Sensory system of earthworms have eyes**
Statement-II: Earth worms have specialized chemoreceptor
 1) Statement-I correct Statement II wrong
 2) Statement-I wrong , Statement-II correct
 3) Both Statements are correct
 4) Both Statements are wrong
80. **Spermathecal apertures and Spermathecae of pheretima are respectively present in**
 1) 5/6, 6/7, 7/8, 8/9 & 5, 6, 7, 8 segment
 2) 5/6, 6/7, 7/8, 8/9 & 7, 8, 9, 10 segment
 3) 5, 6, 7, 8 & 5/6, 6/7, 7/8, 8/9 segments
 4) 5/6, 6/7, 7/8, 8/9 and 6, 7, 8, 9 segments
81. **Function of spermathecae in Earthworm is to**
 1) Secrete substance that form cocoons

- 2) Receive spermatogonia for maturation
 3) Receive sperm during copulation for storage
 4) Receive Ova during copulation

82. **In earthworm testes occur in segments**

- 1) 10 & 11
 2) 12 & 13
 3) 14 & 15
 4) 17 & 18

83. **Prostate gland in pheretima are present in the segment**

- 1) 15th / 16th to 20th / 21st
 2) 16th / 17th to 20th / 21st
 3) 17th – 18th
 4) 17th – 19th

84. **Fertilization in pheretima occur in**

- 1) Coelom
 2) Spermathecae
 3) Cocoon
 4) Seminal vesicle

85. **Spermatozoa of Earthworm mature in the sacs present in --- & --- segments**

- 1) 10th & 11th
 2) 11th & 12th
 3) 12th & 13th
 4) 13th & 14th

SECTION B

86. **Number of cocoons formed after each mating in pheretima are**

- 1) One
 2) Four cocoons
 3) Three
 4) Many cocoons

87. **Number of earthworms formed in each cocoon, on an average ?**

- 1) 2
 2) 1
 3) 4
 4) many

88. **The common Indian earthworms are**

- 1) Pheretima & Lumbricus
 2) Megascoides australis
 3) Chaetogaster annandalei
 4) Megascoclex maruti

89. Match the following structures and their location in earth worm

- | | |
|---------------------|--|
| a) Testes | i) 13 th segment |
| b) Ovaries | ii) 10 th , 11 th segment |
| c) Seminal vesicles | iii) 11 th , 12 th segment |
| d) Prostatic gland | iv) 17 th – 20 th segment |
| e) Accessory gland | v) 17 th & 19 th segment |

A B C D E

- | | | | | |
|--------|-----|-----|----|---|
| 1) III | II | IV | I | V |
| 2) II | I | III | IV | V |
| 3) II | III | IV | I | V |
| 4) III | I | II | IV | V |

90. The oldest segment in earth worm is

- 1) Prostomium
- 2) Pygidium
- 3) Peristomium
- 4) Pre anal segment

91. Dorsal surface of earthworm is dark brown colour due to the presence of

- 1) Chitin
- 2) Collagen
- 3) Keratin
- 4) Porphyrin

92. The function of blood glands is the production of

- 1) Only hemoglobin
- 2) Hemoglobin & blood cells
- 3) plasma
- 4) Phagocytes only

93. Which of the following is not true about prostomium

- 1) First body segment bearing mouth
- 2) A Lobe that covers the mouth
- 3) Sensory in functions
- 4) act as wedge to open cracks in the soil

94. Statement-I : Earth worms are known as Friends of Farmers

Statement-II : They are also used as bait in game fishing

- 1) Statement-I correct Statement II wrong
- 2) Statement-I wrong , Statement-II correct
- 3) Both Statements are correct
- 4) Both Statements are wrong

95. Statement-I : Earth worm development is Indirect

Statement-II : Earth worm Exhibit larva, stage

- 1) Statement-I correct Statement II wrong
- 2) Statement-I wrong , Statement-II correct
- 3) Both Statements are correct
- 4) Both Statements are wrong

96. Arrange the layers of body wall from outside to inside

- | | |
|--------------------------------|-------------------|
| A) Epidermis | B) Cuticle |
| C) Circular muscles | |
| D) Longitudinal muscles | |
| E) Parietal peritonium | |

- 1) A B C D E
- 2) B C D A E
- 3) C A B D E
- 4) B A C D E

97. Segment of earthworm which does not contain any apertures

- 1) Segment – one
- 2) Segment – two
- 3) Pygidium
- 4) Clitellum

98. In Earthworm blood glands are present in

- 1) 4, 5, 6
- 2) 5, 6, 7
- 3) 3, 4, 5
- 4) 1, 2, 3

99. Which one of the following structures in Pheretima is correctly matched with its function

- 1) Gizzard – Grinding mill
- 2) Typhlosole – Excretion
- 3) Setae – Sensory structure
- 4) Clitellum – Production of ova

100. Which type of Coelom exhibited by Earthworm

- 1) Acoelom
- 2) Pseudocoelom
- 3) Schizocoelom
- 4) Enterocoelom

**PHYSICS
SECTION A**

101. It is raining vertically downwards. To protect himself from the rain, a man walking on a horizontal road should hold an umbrella along the direction of

- 1) Relative velocity of man with respect to rain
- 2) Relative velocity of rain with respect to man
- 3) Neither 1 nor 2
- 4) Both 1 and 2

102. For a man walking on a horizontal road it appears to rain with 1.5 times his velocity. If it is actually raining vertically downwards, the angle at which an umbrella is to be held with the vertical to protect himself from rain is

- 1) $\sin^{-1}\left(\frac{1}{3}\right)$
- 2) $\cos^{-1}\left(\frac{3}{5}\right)$
- 3) $\tan^{-1}\left(\frac{2}{\sqrt{5}}\right)$
- 4) $\sin^{-1}\left(\frac{3}{\sqrt{5}}\right)$

103. When it rains vertically downwards, for a man walking on a horizontal road, the ratio of velocity of rain as it appears and actual velocity of rain is found to be $2:\sqrt{3}$. The angle made by an umbrella with the horizontal is

- 1) 30°
- 2) 60°
- 3) 45°
- 4) 90°

104. For a man walking with certain speed it appears to rain vertically down wards. When he doubles his speed it appears to rain at 30° to the vertical. The angle made by the actual velocity of rain with the vertical is

- 1) 60°
- 2) 45°
- 3) 30°

4) 0°

105. It is raining at an angle of θ with the vertical with a speed u . A man runs against the rain with speed v and finds that the direction of rain is at an angle ϕ with the vertical. The value of $\tan \phi$ is equal to

- 1) $\frac{u + v \sin \theta}{v \cos \theta}$
- 2) $\frac{u + v \cos \theta}{v \sin \theta}$
- 3) $\frac{v + u \cos \theta}{v \sin \theta}$
- 4) $\frac{v + u \sin \theta}{u \cos \theta}$

106. When there is no wind, it rains vertically downwards with 3m/s. When wind blows horizontally it appears to rain with 5m/s. The velocity of wind is

- 1) 3 m/s
- 2) 4 m/s
- 3) $3\sqrt{2} \text{ m/s}$
- 4) $5\sqrt{2} \text{ m/s}$

107. A man is walking on a horizontal road with a certain velocity. When it rains vertically downwards, it appears to strike him with double his velocity. The ratio of actual velocity of rain to that of the man is

- 1) $1:\sqrt{3}$
- 2) $\sqrt{3}:1$
- 3) $2:1$
- 4) $1:3$

108. For a man climbing up a steep hill with a velocity $(2\mathbf{i} + 3\mathbf{j})$ m/s it appears to rain vertically down wards with 4 m/s. If the man comes down in the opposite direction the magnitude of relative velocity of rain with respect to man is

- 1) 5 m/s
- 2) $4\sqrt{5} \text{ m/s}$
- 3) $5\sqrt{2} \text{ m/s}$
- 4) $2\sqrt{5} \text{ m/s}$

109. A man running on a horizontal road holds an umbrella vertically upwards to protect himself from the rain. The actual direction of the rain is
- 1) Vertically downwards
 - 2) From the front side of the man
 - 3) From the back side of the man
 - 4) along horizontal direction
110. It is raining at an angle of 30° to the vertical. When a boy runs against the rain with 3 m/s on a horizontal road it appears to rain at 60° to the vertical. The actual velocity of the rain is
- 1) $\sqrt{3} \text{ m/s}$
 - 2) 3 m/s
 - 3) $\frac{1}{\sqrt{3}} \text{ m/s}$
 - 4) $2\sqrt{3} \text{ m/s}$
111. It rains vertically downwards with 4 m/s. A boy running on a horizontal road with 10.8 KMPH holds an umbrella at an angle θ to the horizontal. The value of θ is
- 1) 37°
 - 2) 45°
 - 3) 53°
 - 4) 60°
112. A person is running from West to East with 7m/s and wind also blows in the same direction with 3m/s. If it rains vertically downwards with 3m/s, then the angle made by an umbrella with the vertical to protect from rain is
- 1) 45°
 - 2) 30°
 - 3) 37°
 - 4) 53°
113. Starting at a point A on one bank of a flowing stream of width d a person swims to exactly opposite bank and returns to A in a time 20 minutes. The time taken to swim a distance d along the river and to return to A again is 10 minutes. The time taken to swim a distance 2d in still water is
- 1) 10 min
 - 2) 20 min
 - 3) 40 min
 - 4) 15 min
114. To reach the exactly opposite bank a person has to swim at an angle of 150° with the flow of water. The ratio of velocity of the person to that of river water is
- 1) $2 : \sqrt{3}$
 - 2) $\sqrt{3} : \sqrt{2}$
 - 3) $\sqrt{3} : 2$
 - 4) $3 : \sqrt{2}$
115. A person can row a boat in still water with 2 m/s. When rowed across a river flowing with 1.8 KMPH the drift due to the flow is 100 meters. The width of the river is
- 1) 400 m
 - 2) 2 KM
 - 3) 200 m
 - 4) 1 KM
116. A river is flowing from south to north with 2 m/s. A person can swim in still water with 4 m/s. Starting from west bank to cross the river in shortest time he should swim
- 1) 30° N of E
 - 2) Due South
 - 3) 60° S of E
 - 4) Due East
117. A boat takes 4 hours for upstream and 2 hours for downstream to travel the same distance. The ratio of velocity of boat to velocity of water in the river is
- 1) 1 : 2
 - 2) 2 : 1
 - 3) 3 : 1
 - 4) 1 : 3
118. To cross a river of width $2\sqrt{3}$ KM along a path of shortest time a boat undergoes a displacement of 4 KM. The drift due to the flowing water is
- 1) 1 KM
 - 2) $\sqrt{3}$ KM
 - 3) 2 KM

- 4) $\sqrt{2}$ KM
119. A boat moves perpendicular to the bank of a river flowing with 7.2 KMPH. If the drift downstream is 150 m, the time required to cross the river is
- 1) 2 min 45 sec
 - 2) 1 min 15 sec
 - 3) 30 sec
 - 4) 1 min 30 sec
120. A person swims with 0.5 m/s at an angle of 120° with the direction of flow of water in a stream. If he reaches exactly opposite bank the velocity of water in the stream is
- 1) 2 m/s
 - 2) 0.67 m/s
 - 3) 0.25 m/s
 - 4) 0.75 m/s
121. Water in a 3 KM wide river flows with 3 KMPH. If a person swims across it with 4 KMPH, the drift on reaching the other bank is
- 1) 1125 m
 - 2) 2250 m
 - 3) 625 m
 - 4) 1250 m
122. Water in a river flows with 8 m/s. A person swims with 5 m/s at an angle of 127° with the direction of flow. If the drift on reaching the other bank is 150 meters, the width of the river is
- 1) 200 m
 - 2) 180 m
 - 3) 120 m
 - 4) 280 m
123. Two persons A and B can swim in still water with 5 m/s. They swim in a river of width 200 meters such that A swims along a shortest path and B along a path of shortest time. If water in the river flows with 3 m/s, the time interval between them on reaching the other bank is
- 1) 5 sec
 - 2) 10 sec
 - 3) 20 sec
 - 4) 40 sec
124. A river flows due south with 2 m/s. A boat moves in the river so that the relative velocity of boat with respect to river is due east and equal to 4 m/s. The angle made by the velocity of boat with the flow of water is
- 1) 30°
 - 2) 60°
 - 3) $\tan^{-1}\left(\frac{1}{2}\right)$
 - 4) $\tan^{-1}(2)$
125. When a person swims in a river, he finds that the difference in time between shortest path and path of shortest time is 5 seconds. If the person can swim in still water with 5 m/s and velocity of water is 3 m/s, then the width of the river is
- 1) 50 m
 - 2) 100 m
 - 3) 200 m
 - 4) 150 m
126. The width of a river is 80 m. A person can row a boat in still water with 10 m/s. If the difference in time for shortest path of shortest time is 2 sec then the velocity of river is
- 1) 2 m/s
 - 2) 4 m/s
 - 3) 6 m/s
 - 4) 8 m/s
127. A river is 2 K.M. wide. A person can row a boat in still water with 5 KMPH. If he takes 30 minutes to reach the exactly opposite bank, the velocity of water in the river is
- 1) $\frac{2}{3}$ m / s
 - 2) $\frac{5}{6}$ m / s
 - 3) $\frac{1}{4}$ m / s
 - 4) $\frac{3}{4}$ m / s

128. The width of river is d . When a person swims across the river at right angles to the flow of water the drift is x . If the velocity of the river is u and that of the person is v in still water, then the time taken to reach the other bank is
- 1) $\frac{d}{v}$
 - 2) $\frac{\sqrt{d^2 + x^2}}{\sqrt{u^2 + v^2}}$
 - 3) Both 1 and 2
 - 4) Neither 1 nor 2
129. A person can swim a distance d in still water in a time of 10 minutes. The time taken to cross a river of width d flowing with 5 m/s along a path of shortest time is
- 1) Less than 10 min
 - 2) Equal to 10 min
 - 3) More than 10 min
 - 4) Data insufficient
130. Starting from a point A on one bank, to reach the exactly opposite bank B a person has to swim at an angle of 135° with the direction of flow of water. Two persons P and Q swim at angles 127° and 143° with the direction of flow of the water. Then
- 1) P reaches to the right of B
 - 2) Q reaches to the left of B
 - 3) Both 1 and 2
 - 4) Neither 1 nor 2
131. A boat takes 4 hours to travel a certain distance downstream and takes 6 hours to travel the same distance upstream. The time taken by the boat to travel the same distance in still water is
- 1) 4.8 hours
 - 2) 6 hours
 - 3) 2 hours
 - 4) 8 hours
132. Two persons P and Q can swim in still water with 5m/s. In a river flowing with 10m/s they swim at angles 127° and 143° respectively with the flow of water. The ratio of drifts of P and Q on reaching the other bank is
- 1) 4 : 5
 - 2) 7 : 8
 - 3) 3 : 7
 - 4) 4 : 7
133. Water in a river of width 2 KM flows with 3 KMPH. A person can swim in still water with double the velocity of water in the river. The time taken to reach the exactly opposite bank of the river is
- 1) 34 min
 - 2) 28 min
 - 3) 23 min
 - 4) 18 min
134. A person can swim in still water with 3 m/s. It takes 20 seconds for him to swim 100 meters downstream in a river. The time taken to swim the same distance upstream in the same river is
- 1) 40 sec
 - 2) 60 sec
 - 3) 80 sec
 - 4) 100 sec
135. Two persons A and B can swim in still water with 5 m/s. They swim a 100 meters wide river such that, A swims along a shortest path and B swims along a path of shortest time. If water in the river flows with 3m/s, the velocity with which B has to walk on the other bank so that they reach the exactly opposite bank at the same time is
- 1) 10 m/s
 - 2) 12 m/s
 - 3) 15 m/s
 - 4) 20 m/s

SECTION B

136. Water in a river flows with 2 kmph. A person can swim with 3 kmph in still water. The time taken to swim a distance of 500 m downstream is
- 1) 6 min
 - 2) 1 hr
 - 3) 30 min
 - 4) 20 min
137. A person can swim in still water with 6 KMPH. Water in a river flows with 4 KMPH. In a time of 15 min, the distance the person can swim upstream is
- 1) 100 m
 - 2) 500 m
 - 3) 1 KM
 - 4) 200 m
138. Water in a river flows with 3 m/s. If the ratio of times taken by a person to swim the same distance first downstream and then upstream is 1 : 4, the velocity with which the person can swim in still water is
- 1) 1 m/s
 - 2) 3 m/s
 - 3) 5 m/s
 - 4) 2 m/s
139. A person can swim in still water with 5 m/s. Water in a river flows with 3 m/s. The total time taken to travel a distance of 200 m along the river and come back is
- 1) 3 min 20 sec
 - 2) 5 min
 - 3) 2 min 5 sec
 - 4) 4 min
140. A person can swim with twice the velocity of flow of water in a river. To reach the exactly opposite bank, the angle to be made with the direction of flow is
- 1) 135°
 - 2) 120°
 - 3) 150°
 - 4) 90°
141. The width of a river is 1 K.M. A person can swim in still water with 5 KMPH. If the time taken to reach exactly opposite bank is 15 minutes, the velocity of flow of water is

- 1) 4 KMPH
- 2) 2 KMPH
- 3) 5 KMPH
- 4) 3 KMPH

142. A person can row a boat in still water with 8 KMPH. When rowed across a river of 400 meters wide, the drift due to river water is 200 meters. The velocity of river water is nearly,

- 1) 4 m/s
- 2) 1 m/s
- 3) 6 m/s
- 4) 3 m/s

143. It rains vertically downwards with 6 m/s. A person rides a bicycle in east to west direction with 4 m/s. To protect himself from the rain the direction in which an umbrella is to be held is

- 1) At an angle $\tan^{-1}\left(\frac{3}{2}\right)$ with vertical towards east

- 2) At an angle $\tan^{-1}\left(\frac{2}{3}\right)$ with vertical towards west

- 3) At an angle $\tan^{-1}\left(\frac{3}{2}\right)$ with vertical towards west

- 4) At an angle $\tan^{-1}\left(\frac{2}{3}\right)$ with vertical towards east

144. For a person walking on a horizontal road with 5 KMPH it appears to rain with a velocity 13 KMPH. If it is raining vertically downwards, the actual velocity of rain is

- 1) 10 KMPH
- 2) 12 KMPH
- 3) 7 KMPH
- 4) 9 KMPH

145. A person rides a bicycle with a speed of 1.732 m/s towards North. It rains vertically downwards with 1m/s. To protect himself from the rain the angle to be made by an umbrella with horizontal is

- 1) 60^0
- 2) 45^0
- 3) 30^0
- 4) 90^0

146. A shower of rain appears to fall vertically downwards with 4 KMPH. For a person walking westwards with 3KMPH, the actual velocity of rain and direction are

- 1) 5 KMPH towards West
- 2) 2 KMPH towards West
- 3) $\sqrt{7}$ KMPH towards East
- 4) $\sqrt{7}$ KMPH towards West

147. It is raining with a speed of 5 m/s at an angle of 37^0 with the vertical towards East. A man travels towards west with 5 m/s. To protect himself from rain the angle to be made by an umbrella with vertical and its direction is

- 1) $\tan^{-1}\left(\frac{1}{2}\right)$ towards West
- 2) $\tan^{-1}\left(\frac{1}{2}\right)$ towards East
- 3) $\tan^{-1}(2)$ towards West
- 4) $\tan^{-1}(2)$ towards East

148. The ratio of velocity of boat to the velocity of river is 3 : 2. The ratio of times taken to travel upstream and downstream the same distance is

- 1) 4 : 3
- 2) 7 : 5
- 3) 5 : 1
- 4) 8 : 5

149. Water in a river flows with 6 m/s. A person can row a boat in still water with 10 m/s. The ratio of times taken along a shortest path and a path of shortest time to cross the river is

- 1) 3 : 2
- 2) 5 : 4
- 3) 7 : 5
- 4) 8 : 5

150. To cross a stream along a path of shortest time a person takes 2 minutes. If water in the stream flows with 2 m/s the drift on the other bank is

- 1) 80 m
- 2) 100 m
- 3) 240 m
- 4) 150 m

CHEMISTRY SECTION A

151. Which of the following element is not an inner transition element ?

- 1) Ce
- 2) Cs
- 3) Es
- 4) Sm

152. The metal which exist in liquid state at room temperature is

- 1) Br
- 2) Ga
- 3) Hg
- 4) Na

153. 5f series elements belongs to

- 1) 6th period and III B group
- 2) 7th period and II B group
- 3) 6th period and II B group
- 4) 7th period and III B group

154. If the differentiating electron enters (n-1)d sub shell, the element is

- 1) A noble gas
- 2) A transition element
- 3) An alkali metal
- 4) A representative element

155. The correct statement regarding transition elements is

- 1) They mostly form coloured ions
- 2) They exhibit variable oxidation states
- 3) They have the general outer electron configuration (n-1) $d^{1-10} ns^{0-2}$
- 4) All the above

156. Which of the following is not a transition element ?

- 1) Zr
- 2) Zn
- 3) Sc

- 4) Ag
157. When a neutral atom is converted into the anion its
- 1) Atomic number increases
 - 2) Mass number increases
 - 3) Size increases
 - 4) Size decreases
158. The correct order of variation in the sizes of atoms is
- 1) $B < C < F < Ne$
 - 2) $B < F < C < Ne$
 - 3) $C < B < Ne < F$
 - 4) $F < C < B < Ne$
159. The correct order of sizes of species Fe, Fe^{+2} and Fe^{+3} is
- 1) $Fe > Fe^{+2} > Fe^{+3}$
 - 2) $Fe^{+2} > Fe^{+3} > Fe$
 - 3) $Fe^{+3} > Fe^{+2} > Fe$
 - 4) $Fe > Fe^{+3} > Fe^{+2}$
160. The order of screening effect of the electrons of s, p, d and f – orbitals of a given shell of an atom on its outer shell electrons is
- 1) $f > d > p > s$
 - 2) $s > p > d > f$
 - 3) $s > d > p > f$
 - 4) $f > p > d > s$
161. Which of the following sets of elements would have nearly same atomic radii
- 1) Na, K, Rb, Cs
 - 2) F, Cl, Br, I
 - 3) Na, Mg, Al, Si
 - 4) Fe, Co, Ni, Cu
162. The effective nuclear charge in the alkali metals from Na to Cs
- 1) Increases
 - 2) Decreases
 - 3) Remains constant
 - 4) First increases then decreases
163. Metal used as catalyst in the hydrogenation of vegetable oils
- 1) Fe
 - 2) Ni
 - 3) Mo
 - 4) Na
164. Noble gas element which has a different electronic configuration in the valence shell
- 1) He
 - 2) Ne
 - 3) Kr
 - 4) Xe
165. The correct order of size of F, O, O^{2-} , F^{-} is
- 1) $O > F > O^{2-} > F^{-}$
 - 2) $F > F^{-} > O > O^{2-}$
 - 3) $O^{2-} > F^{-} > O > F$
 - 4) $O > O^{2-} >> F > F^{-}$
166. Which of the following pair is not an isoelectronic?
- 1) Fe^{+3} , Mn^{+2}
 - 2) Na^{+} , O^{2-}
 - 3) Ca^{+2} , S^{2-}
 - 4) Ne, Cl^{-}
167. The screening constant for a 3d- electron in Zn is
- 1) 25.65
 - 2) 21.15
 - 3) 8.85
 - 4) 30.0
168. O^{2-} and Si^{+4} are iso electronic ions. If the ionic radius of O^{2-} is $1A^0$, the ionic radius of Si^{+4} will be
- 1) $1.4 A^0$
 - 2) $2.8 A^0$
 - 3) $1.5 A^0$
 - 4) $0.41 A^0$
169. Which one is the correct order of the size of the iodine species
- 1) $I^{-} > I^{+} > I$
 - 2) $I^{-} > I > I^{+}$
 - 3) $I^{+} > I > I^{-}$
 - 4) $I > I^{+} > I^{-}$
170. Crystal radius of potassium is $2.31 A^0$. Then covalent radius of 'K' will be
- 1) $< 2.31 A^0$
 - 2) $> 2.31 A^0$

3) equal to 2.31 \AA^0

$$4) = \frac{2.31}{2} \text{ \AA}^0$$

171. If an element 'X' is assumed to have the types of radii, then their order is

- 1) Crystal radius > Covalent radius > Vander Waals radius
- 2) Vander Waals radius > Covalent radius > Crystal radius
- 3) Covalent radius > Vander Waal radius > Crystal radius
- 4) Vander Waal radius > Crystal radius > Covalent radius

172. Covalent bond length of Fluorine molecule is 1.44 \AA^0 . Then covalent radius of Fluorine is

- 1) 1.44 \AA^0
- 2) 0.72 \AA^0
- 3) 2.16 \AA^0
- 4) 2.88 \AA^0

173. Consider the isoelectronic species, S^{-2} , Ca^{+2} , K^+ , P^{-3} and Ar. The correct order of increasing their size is

- 1) $\text{S}^{-2} < \text{K}^+ < \text{P}^{-3} < \text{Ca}^{+2} < \text{Ar}$
- 2) $\text{Ar} < \text{K}^+ < \text{Ca}^{+2} < \text{P}^{-3} < \text{S}^{-2}$
- 3) $\text{Ca}^{+2} < \text{K}^+ < \text{Ar} < \text{S}^{-2} < \text{P}^{-3}$
- 4) $\text{P}^{-3} < \text{S}^{-2} < \text{Ar} < \text{K}^+ < \text{Ca}^{+2}$

174. Which one of the ion has smallest radius

- 1) N^{-3}
- 2) K^+
- 3) S^{-2}
- 4) Ca^{+2}

175. Atomic radii of Fluorine and Neon in angstrom units are respectively

- 1) 0.72, 0.72
- 2) 0.72, 1.62
- 3) 1.2, 1.2
- 4) 1.62, 0.72

176. Correct order of atomic radii is

- 1) $\text{C} < \text{N} < \text{S} < \text{P}$
- 2) $\text{C} < \text{N} < \text{P} < \text{S}$
- 3) $\text{N} < \text{C} < \text{P} < \text{S}$
- 4) $\text{N} < \text{C} < \text{S} < \text{P}$

177. Which of the following atom has largest size?

- 1) Br
- 2) I
- 3) I
- 4) F

178. In a period, atom with smaller radius is

- 1) Chalcogen
- 2) Halogen
- 3) Alkali metal
- 4) Noble gas

179. Which of the following process refers to ionization potential ?

- 1) $\text{M}_{(\text{g})} \rightarrow \text{M}_{(\text{g})}^+ + \text{e}^-$
- 2) $\text{M}_{(\text{s})} \rightarrow \text{M}_{(\text{g})}^+ + \text{e}^-$
- 3) $\text{M}_{(\text{g})} + \text{aq} \rightarrow \text{M}_{(\text{aq})}^+ + \text{e}^-$
- 4) $\text{M}_{(\text{g})} + \text{e}^- \rightarrow \text{M}_{(\text{q})}^+$

180. The element with highest ionization potential is

- 1) Neon
- 2) Oxygen
- 3) Helium
- 4) Nitrogen

181. In which pair, the first species is not larger in size than the second ?

- 1) Br^- , Br
- 2) Pb^{+2} , Pb^{+4}
- 3) N, F
- 4) N, P

182. Which of the following represents the IE_2 (second ionization enthalpy) of an element M.

- 1) $\text{M}_{(\text{g})} \rightarrow \text{M}_{(\text{g})}^{+2} + 2\text{e}^-$
- 2) $\text{M}_{(\text{g})} \rightarrow \text{M}_{(\text{g})}^+ + \text{e}^-$
- 3) $\text{M}_{(\text{g})}^+ \rightarrow \text{M}_{(\text{g})}^{++} + \text{e}^-$
- 4) $\text{M}_{(\text{g})}^+ + \text{e}^- \rightarrow \text{M}_{(\text{g})}$

183. Which of the following statement is true ?

- i) $\text{IE} \propto \text{Nuclear charge}$
- ii) $\text{I.E} \propto \frac{1}{\text{screening effect}}$

iii) $IE \propto \frac{1}{\text{Atomic size}}$

iv) $IE \propto \text{Positive charge on the element}$

- 1) All the above
- 2) Only i, ii & iii
- 3) Only i & ii
- 4) Only ii & iii

184. If the atomic radius of non metal Bromine is 1.14 \AA^0 its covalent radius is

- 1) 1.12 \AA^0
- 2) 1.16 \AA^0
- 3) 1.14 \AA^0
- 4) 0.57 \AA^0

185. Among the elements with the following electronic configurations, the one with the largest radius is

- 1) $1s^2 2s^2 2p^3$
- 2) $1s^2 2s^2 2p^2$
- 3) $1s^2 2s^2 2p^4$
- 4) $1s^2 2s^2$

SECTION B

186. The atomic radii of inert gases are usually expressed in terms of

- 1) Covalent radii
- 2) Vander Waal radii
- 3) Crystal radius
- 4) Any of the above

187. The screening constant (σ) value of valence electron in oxygen is

- 1) 3.10
- 2) 3.80
- 3) 3.45
- 4) 4.15

188. The correct decreasing order of atomic radii for Be, Na & Mg is

- 1) $\text{Na} > \text{Be} > \text{Mg}$
- 2) $\text{Mg} > \text{Be} > \text{Na}$
- 3) $\text{Be} > \text{Na} > \text{Mg}$
- 4) $\text{Na} > \text{Mg} > \text{Be}$

189. the value of 1 eV / atom is

- 1) 23.06 Kcals / mole
- 2) 96.45 KJ / mole
- 3) 1.602×10^{-19} Joules / atom

4) All of these

190. For any atom, the order of ionization potential values is

- 1) $IE_1 < IE_2 < IE_3$
- 2) $IE_3 < IE_2 < IE_1$
- 3) $IE_1 < IE_3 < IE_2$
- 4) $IE_2 < IE_3 < IE_1$

191. Which of the following transition involves maximum amount of energy

- 1) $M_{(g)} \rightarrow M_{(g)}^+$
- 2) $M_{(g)}^{+2} \rightarrow M_{(g)}^{+3}$
- 3) $M_{(g)}^+ \rightarrow M_{(g)}^{+2}$
- 4) $M_{(g)}^- \rightarrow M_{(g)}$

192. The atomic radii of two elements 'X' and 'Y' are 0.72 \AA^0 and 1.6 \AA^0 . Then the elements 'X' and 'Y' are respectively

- 1) Ne & F
- 2) Li & Be
- 3) F & Ne
- 4) K & Na

193. Highest amount of energy will be required for the removal of the electron from

- 1) s - subshell
- 2) p - subshell
- 3) d - subshell
- 4) f - subshell

194. The internuclear distance between any two carbon atoms in diamond is 154 pm, so the covalent radius is equal to

- 1) 154 pm
- 2) 308 pm
- 3) 77 pm
- 4) 32 pm

195. Zr belongs to 4d - series, whereas Hf belongs to 5d - series but their atomic radii are same, this due to

- 1) Same effective nuclear charge
- 2) Same no. of electrons in the valence shell
- 3) Lanthanide contraction
- 4) Same metallic character

196. In case of multi electron atoms or ions, the effective nuclear charge (Z_{eff}) can be calculated by the formula

- 1) $Z_{\text{eff}} = Z + \sigma$
- 2) $Z_{\text{eff}} = Z / \sigma$
- 3) $Z_{\text{eff}} = Z - \sigma$
- 4) $Z_{\text{eff}} = Z \sigma^2$

197. Which of the following has smallest ionic radius ?

- 1) Cr^{+6}
- 2) Cr^{+5}
- 3) Cr^{+4}
- 4) Cr^{+3}

198. For the transition elements, the variations in atomic radii are not so regular because electrons are being added to the ____ sub shell

- 1) $(n+1)d$
- 2) $(n-1)d$
- 3) $n d$
- 4) $(n-2)d$

199. The electronic configurations of four elements are given below. Arrange these elements in the correct order of their atomic radii

- | | |
|------------------|-----------------|
| i) $2s^2 2p^5$ | ii) $3s^2 3p^4$ |
| iii) $3s^2 3p^5$ | iv) $2s^2 2p^4$ |

- 1) $i < ii < iii < iv$
- 2) $iii < iv < iii < i$
- 3) $i < iv < iii < ii$
- 4) $ii < iii < i < iv$

200. Which of the following sets of ions represents the collection of isoelectronic species ?

- 1) $\text{Na}^+, \text{Mg}^{+2}, \text{Al}^{+3}, \text{Cl}^-$
- 2) $\text{K}^+, \text{Ca}^{+2}, \text{Sc}^{+3}, \text{Cl}^-$
- 3) $\text{Na}^+, \text{Ca}^{+2}, \text{Sc}^{+3}, \text{F}^-$
- 4) $\text{K}^+, \text{Cl}^-, \text{Mg}^{+2}, \text{Sc}^{+3}$