ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2023
EXAMINATION CATEGORY: TECHNICAL

PAPER II: GENERAL SUBJECT KNOWLEDGE PAPER FOR BIO SCIENCE

Date	: October 6, 2023
Total Marks	: 100
Writing Time	: 90 minutes (1.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of the Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO Parts: Part I & Part II**

   Part I consists of 70 multiple choice questions of 1 (one) mark each, and

   Part II consists of 10 short answer questions of 3 (three) marks each.

4. All questions are COMPULSORY.
5. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
6. **All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating any or correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.**
7. Begin each Part on a fresh page of the Answer Booklet.
8. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
9. Use of any other paper including paper for rough work is not permitted.
10. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
11. This paper has **11 printed pages**, including this instruction page.

GOOD LUCK!

Part I

Multiple Choice Questions [70 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 71 (a). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Mobilisation of stored food in germinating seed is triggered by:
   a) ABA
   b) Cytokinin
   c) GA
   d) Ethylene

2. Which hormone causes dilation of blood vessels, increased oxygen consumption and glucogenesis?
   a) Glycogen
   b) Insulin
   c) ACTH
   d) Adrenaline

3. PGA as the first carbon dioxide fixation product was discovered in photosynthesis of:
   a) Angiosperm
   b) Alga
   c) Bryophyte
   d) Gymnosperm

4. The theory of use and disuse of organ was propose by:
   a) Darwin
   b) deVries
   c) Lamarck
   d) Hooker

5. Which of the following statements is **INCORRECT**?
   a) Enzymes are in colloidal state.
   b) Enzymes are catalysts.
   c) Enzymes can catalyse any reaction.
   d) Urea is an enzyme.

6. Sulphur is an important nutrient for optimum growth and productivity in:
   a) Oilseed crops
   b) Cereals
   c) Pulse crops
   d) Fibre crops

7. 10 g of NaCl is dissolved in 10^6 g of the solution. Its concentration is:
   a) 0.1 ppm
   b) 1.0 ppm

c) 10 ppm
d) 100 ppm

8. Morphine, which is used as analgesic is obtained from:
   a) *Cinchona officinalis*
   b) *Papaver somniferum*
   c) *Taxus brevifolia*
   d) *Berberis nilghiriensis*

9. Alzheimer's disease in human is associated with the deficiency of:
   a) Dopamine
   b) Glutamic acid
   c) Gamma Amino Butyric Acid
   d) Acetylcholine

10. Bartholin's glands of female correspond to which glands in male?
   a) Cowper's glands
   b) Inguinal glands
   c) Prostate glands
   d) Rectal glands

11. For weak acid-strong base titration, the indicator used is:
   a) Methyl orange
   b) Blue litmus.
   c) Phenolphthalein
   d) $K_2Cr_2O_7$

12. An apparatus used for the measurement of quantity of electricity is known as:
   a) Calorimeter
   b) Coulometer
   c) Colorimeter
   d) None of the above

13. Which of the following induces flowering in long day plants?
   a) Gibberellins
   b) Auxins
   c) Cytokinin
   d) Eythylene

14. Fossil bird having reptilian characters evolved during which period?
   a) Jurassic
   b) Carboniferous
   c) Triassic
   d) Cretaceous

15. Phylogenetic classification of plant was proposed by:
   a) Lamarck
   b) Linnaeus
   c) Oswald Tippo t

d) Hutchinson

16. pH of solution can be expressed as:
    a) $\log_{10}[H^+]$
    b) $-\log_e[H^+]$
    c) $-\log_{10}[H^+]$
    d) $\text{Log}_e[H^+]$

17. Which pigment involves in photoperiodic change in plants?
    a) Chlorophyll
    b) Phytochrome
    c) Cytochrome
    d) Anthocyanin

18. The deteriorative process in plants that naturally terminate their functional life are collectively called:
    a) Wilting
    b) Abscission
    c) Plasmolysis
    d) Senescence

19. Ontogeny recapitulates phylogeny, and this theory is called:
    a) Biogenetic law
    b) Law of embryology
    c) Law of acquired characters
    d) Law of bridges

20. Withdrawal of which of the following hormones is the immediate cause of menstruation?
    a) Estrogen
    b) FSH
    c) FSH-RH
    d) None of the above

21. Among mammals, a significant role in the digestion of milk is played by:
    a) Rennin
    b) Invertase
    c) Amylase
    d) Intestinal bacteria

22. Length of petiole increases due to division of:
    a) Apical meristem
    b) Lateral meristem
    c) Intercalary meristem
    d) All the above

23. Aerenchyma is helpful in plants by
    a) providing buoyancy in hydrophytes.
    b) absorption in stilt roots.

c) giving mechanical strength to plants.
d) giving flex ibility to plants.

24. Major radiation of mammals, birds and pollinating insects took place in which epoch?
    a) Oligocene
    b) Pliocene
    c) Palaeocene
    d) Miocene

25. The spread of gene from one breeding population to another by migration which may result in change in gene frequency is:
    a) Genetic frequency
    b) Genetic drift
    c) Gene flow
    d) Mutation

26. Which type of carbohydrate is cane sugar?
    a) Polysaccharide
    b) Trisaccharide
    c) Disaccharide
    d) None of the above

27. Reagent which reacts with both acetaldehyde and acetone is:
    a) Fehling
    b) Grignard
    c) Schiff's
    d) Tollen's

28. Chromosomal aberrations are caused by
    a) change in the structure of gene.
    b) change in the number of chromosomes.
    c) change in the arrangement or position of genes.
    d) change in the number of arrangement of genes in the chromosomes.

29. The drug which stimulates the nervous system and makes a person more wakeful, alert and active is called:
    a) Sedative
    b) Opiate narcotic
    c) Stimulant
    d) Hallucinogen

30. Aromatic hydrocarbons are known as:
    a) Alkanes
    b) Alkenes
    c) Alkynes
    d) Arenes

31. The ability of plant cells to re-regenerate the complete plants is known as:
    a) Cell cloning
    b) Tissue culture

c) Pleuropotency
d) Totipotency

32. Somatic hybridisation can be done by:
a) Protoplast fusion
b) Haploid anther
c) Cell culture
d) Pollen culture

33. The extra-embryonic membranes of mammalian embryo are derived**:**
a) Trophoblast
b) Follicle cells
c) Formative cells
d) Inner cell mass

34. Volume of 0.6 M NaOH required to neutralise 30 cm^3 of 0.4 M HCl is:
a) 10 cm^3
b) 20 cm^3
c) 30 cm^3
d) 40 cm^3

35. The purplish red pigment rhodopsin contained in the rods type of photoreceptor cells of the human eye is derivative of:
a) Vitamin B_1
b) Vitamin C
c) Vitamin D
d) Vitamin A

36. Tendril of *Cucurbita* and thorns of *Bougainvillea* are examples of:
a) Analogous organs
b) Homologous organs
c) Vestigial organs
d) None of the above

37. The synthesis of complex molecules from simple molecules was proved by:
a) Arrhenius
b) Pasteur
c) Stanley Miller
d) Darwin

38. Production of glucose from amino acids, fatty acids and glycerol is called:
a) Glycolysis
b) Glycogenesis
c) Glycogenolysis
d) Gluconeogenesis

39. An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as:
a) Histamine and dopamine
b) Histamine and kinnis

c) Interferons and semin
d) Interferons and histones

40. A buffer solution can be prepared from a mixture of
a) sodium acetate and acetic acid in water.
b) sodium acetate and hydrochloric acid in water.
c) ammonia and ammonia chloride in water.
d) ammonia and sodium hydroxide in water.

41. Haemophilia is more commonly seen in human males than in human females because
a) this disease is due to an X-linked dominant mutation.
b) a greater proportion of girls die in infancy.
c) this disease is due to Y-linked recessive mutation.
d) this disease is due to X-linked recessive mutation.

42. Lipids, which can be found in oil-based salad dressings and ice cream, during digestion are split into:
a) Fatty acids and glycerol
b) Glycerol and amino acids
c) Glucose and fatty acids
d) Glucose and amino acids

43. The ciliated columnar epithelial cells in humans are known to occur in:
a) Bile duct and oesophagus.
b) Eustachian tube and stomach lining.
c) Fallopian tubes and urethra.
d) Bronchioles and Fallopian tubes.

44. An enzyme which brings about the conversion of starch into maltose is known as:
a) Maltase
b) Invertase
c) Diastase
d) Zymase

45. Hydrolysis of esters in alkaline medium is called:
a) Esterification
b) Saponification
c) Hydration
d) Alkalisation

46. Corm is the modification of:
a) Root
b) Leaf
c) Stem
d) Bud

47. Which one of the following does not exhibit autotomy?
a) Starfish
b) Crab

c) Lizard
d) Hydra

48. Which of the following is considered to be the best chemical method of fixing atmospheric nitrogen?
a) Fisher method
b) Decan method
c) Parnas-Meyerhoff method
d) None of the above

49. The solubility of a gas increases with increase of:
a) Temperature
b) Volume of the gas
c) Pressure
d) Concentration

50. In which of the following oxygen does not evolve during photosynthesis?
a) Photosynthetic red algae
b) Photosynthetic green algae
c) Photosynthetic blue-green algae
d) Photosynthetic bacteria

51. The structural isomers possible for the compounds with molecular formula $C_2H_3Cl_3$ is:
a) 2
b) 3
c) 4
d) 5

52. The lining of intestine and kidneys in human is:
a) Keratinised
b) Brush-bordered
c) Ciliated
d) Stratified squamous

53. Root hair absorb water from soil through:
a) Turgor pressure
b) Ion exchange
c) Osmosis
d) DPD

54. Which of the following is an opioid drug?
a) Cocaine
b) Hashish
c) Marijuana
d) Heroin

55. The molarity of pure water is:
a) 18 M
b) 50.6 M

c) 55.6 M
d) 66.6 M

56. Number of moles of NaOH present in 2 litres of 0.5 M NaOH is:
a) 0.1
b) 1.0
c) 1.5
d) 2.0

57. Most accepted theory for ascent of sap is:
a) Capillarity theory
b) Root pressure theory
c) Transpiration pull theory
d) Pulsation theory

58. Regeneration in animals was first reported by:
a) T.H.Huxley
b) A.G. Trembley
c) T.H. Morgan
d) T.Muller

59. The science of ageing is known as:
a) Chronology
b) Odontology
c) Gynaecology
d) Gerontology

60. Transfer of pollen grains from one flower to another flower of the same plant is called:
a) Allogamy
b) Autogamy
c) Geitonogamy
d) Cleistogamy

61. Which one of the following have the highest number of species in nature?
a) Fungi
b) Insects
c) Birds
d) Angiosperms

62. Carbon-14 dating method is based on the fact that:
a) Carbon-14 fraction is same in all objects
b) Carbon-14 is highly soluble
c) Ratio of carbon-14 and carbon-12 is constant
d) All the above

63. A raw material used in making nylon is:
a) Adipic acid
b) Butadiene
c) Ethylene

d) Methyl methacrylate

64. Which one of the following is used to make 'non-stick' cookware?
a) Polystyrene
b) PVC
c) Polyethylene terephthalate
d) Polyetrafluoro ethylene

65. Biological concept of species is mainly based on:
a) Methods of reproduction only
b) Reproductive isolation
c) Morphological features only
d) Morphology and methods of reproduction

66. Mutation is more common when it is present in:
a) Recessive condition
b) Dominant condition
c) Constant in population
d) None of the above

67. Which of the following is not Darwin's conclusion?
a) Survival of the fittest
b) Struggle for existence
c) Inheritance of acquired characters
d) Origin of species by natural selection

68. Law of limiting factors was given by:
a) Arnon
b) Calvin
c) Leibig
d) Blackman

69. In plants, the guard cells differ from other epidermal cells in having:
a) Cytoskeleton
b) Endoplasmic Reticulum
c) Chloroplasts
d) Mitochondria

70. Which of the following is a bacterium involved in denitrification?
a) *Azotobacter*
b) *Nitrobacter*
c) *Nitrosomonas*
d) *Pseudomonas*

Part II

Short Answer Questions [30 marks]

Answer ALL 10 short answer questions. Each question carries 3 marks.

1. Explain how during light reaction of photosynthesis, ATP synthesis is a chemiosmotic phenomenon?

2. Structural organisation in animals attains different levels as cell-organ-organ system. What is missing in this chain? Mention the significance of such an organization.

3. How are following enzymes activated in the alimentary canal: *Pepsin*, *Trypsin*, and *Rennin*?

4. What role does root pressure play in water movement in plants?

5. A solution of 1.85 g of a solute X in 100 ml of water is found to be isotonic with a 3.42 % (wt/vol) solution of sucrose ($C_{12}H_{22}O_{11}$ = 342). Calculate the relative molecular mass of X.

6. Biological clocks help organisms to maintain adaptive behaviour. Give two examples to justify that circadian rhythmic behaviour in plants is adaptive.

7. What is Warburg effect? What is its relation with photorespiration?

8. Solid substances are classified into three different types depending upon their behaviour towards magnetic field. What are they and briefly define each of them?

9. Which plant hormone is associated with delay of senescence and how? What is Richmond –Lang effect?

10. What are the three characteristics based on which blind spot and yellow spot are differentiated in human eyes? Give the basis of their differentiation?

TASHI DELEK