ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2020
EXAMINATION CATEGORY: TECHNICAL

PAPER II: GENERAL SUBJECT KNOWLEDGE PAPER FOR BIO SCIENCE

Date : February 26, 2021
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 **12 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. Anatomically, fairly old dicotyledonous root is distinguished from the dicotyledonous stem by
   a) absence of secondary xylem.
   b) absence of secondary phloem.
   c) presence of cortex.
   d) position of protoxylem.

2. The chief water conducting elements of xylem in gymnosperms are
   a) Vessels
   b) Fibres
   c) Tracheids
   d) Transfusion tissues

3. The number of moles of solute present in 1 kg of solvent is called its
   a) Molality
   b) Molarity
   c) Normality
   d) Formality

4. The most electronegative element among the following is
   a) Bromine
   b) Sodium
   c) Fluorine
   d) Oxygen

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

6. Which one of the following items gives its correct total number indicated below?
   a) Floating ribs in humans - 4
   b) Amino acids found in proteins - 16
   c) Types of diabetes - 3
   d) Cervical vertebrae in humans - 8

7. Which is common to kidney and skeleton in mammals?
   a) Cortex
   b) Medulla
   c) Radius
   d) Pelvis

8. Breeding of crops with high levels of minerals, vitamins and proteins is called
   a) Somatic hybridisation
   b) Biofortification
   c) Biomagnification
   d) Micropropagation

9. Number of moles of NaOH present in 2 litre of 0.5 M NaOH solution is
   a) 2.0
   b) 2.5
   c) 1.5
   d) 1.0

10. A historic convention of biological diversity held in Rio de Janerio in 1992 is known as the
   a) Geneva convention
   b) Earth Summit
   c) Montreal protocol
   d) Janerio convention

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

12. Which of the following is an organic molecule needed by the body in small amount?
   a) Protein
   b) Zinc
   c) Vitamin - C
   d) Monosaccharide

13. In plant, apical dominance is caused by
   a) Gibberellin
   b) Cytokinin
   c) Ethylene
   d) Auxin

14. When pH of solution is increased from 3 to 5, its H^+ ions concentration will be
    a) reduced to half.
    b) reduced by 100 times.
    c) increased by 100 times.
    d) increased by 1000 times.

15. Coiling of garden pea tendrils around any support is an example of
    a) Thigmotaxis
    b) Thigmonasty
    c) Thigmotropism
    d) Thermotaxis

16. The term "mutation" was introduced by
    a) Hugo deVries
    b) Morgan
    c) Muller
    d) Darwin

17. "The ratio of the concentration of a solute between two liquid phases is constant at a given temperature." This statement is called
    a) Henry's law
    b) Raoult's law
    c) Distribution law
    d) Kirchoff's law

18. The metal that is used as a catalyst in the hydrogenation of oils is
    a) Ni
    b) Cu
    c) Pb
    d) Pt

19. Which extra embryonic membrane in human prevents desiccation of the embryo inside the uterus?
    a) Yolk Sac
    b) Amnion
    c) Chorion
    d) Allantois

20. Which of the following types of leucocytes secretes heparins and histamine?
    a) Acidophils
    b) Monocytes
    c) Basophils
    d) Neutrophils

21. Biosphere reserves differ from national parks and wildlife sanctuaries because in the former
    a) human beings are not allowed to enter.
    b) people are an integral part of the system.
    c) plants are paid more attention than the animals.
    d) living organisms are brought from all over the world and preserved for posterity.

22. The number of moles of KCl in 1000 ml of 3 molar solution is
    a) 2
    b) 3
    c) 4
    d) 5

23. Which of the following is NOT a colligative property?
    a) Elevation in boiling point
    b) Osmotic pressure
    c) Optical activity
    d) Relative lowering of vapour pressure

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

25. Evolutionary history of an organism is known as
    a) Phylogeny
    b) Ancestry
    c) Palaeontology
    d) Ontogeny

26. When two species of different genealogy come to resemble each other as a result of adaptation, the phenomenon is termed as
    a) Co-evolution
    b) Convergent evolution
    c) Divergent evolution
    d) Microevolution

27. Which one of the following factors does not influence the reaction rate?
    a) Concentration of reactants
    b) Order of reaction
    c) Molecularity of the reaction
    d) Orientation of molecules

28. Man-made crop *Triticale* is a hybrid between
    a) Rice and Maize
    b) Wheat and Rye
    c) Rice and Barley
    d) Maize and Barley

29. A collection of plants and seeds having diverse alleles of all the genes of a crop is called
    a) Herbarium
    b) Genome
    c) Germplasm
    d) Gene library

30. If the density of the HCl acid is 1.17 gcm^{-3}, then its molarity is
    a) 36.5
    b) 32.05
    c) 1.17
    d) 35.50

31. Bleaching properties of bleaching powder are due to its
    a) Basic properties
    b) Disinfecting properties
    c) Oxidising properties
    d) Reducing properties

32. Maximum number of vascular bundles is present in
    a) Monocot stem
    b) Monocot root
    c) Dicot stem
    d) Dicot root

33. The lining of intestine and kidneys in human is
    a) Keratinised
    b) Brush-bordered
    c) Ciliated
    d) None of the above

34. Bone marrow is made up of
    a) muscular fibre and fatty tissue.
    b) fatty tissue and areolar tissue.
    c) fatty tissue and cartilage.
    d) fatty tissue, areolar tissue and blood vessel.

35. Calcium acetate on heating yields
    a) CaO, CO_2, and H_2O
    b) $CaCO_3$ and H_2O
    c) $CaCO_3$ and CH_3COCH_3
    d) CH_3CHO and $CaCO_3$

36. Formaldehyde and formic acid can be distinguished by
    a) Tollen's reagent
    b) Fehling's solution
    c) Sodium carbonate
    d) Benedict reagent

37. Sugar on hydrolysis gives
    a) L (+) glucose + D(+) fructose
    b) L (-) glucose + L(-) fructose
    c) D (+) glucose + D(-) fructose
    d) D (+) glucose + L(-) fructose

38. In which of the following is oxygen not evolved during photosynthesis?
    a) Photosynthetic red algae
    b) Photosynthetic green algae
    c) Photosynthetic blue-green algae
    d) Photosynthetic bacteria

39. In plasmolysed cell, the space between nucleus and plasma membrane is occupied by
    a) Hypertonic solution
    b) Hypotonic solution
    c) Isotonic solution
    d) Air

40. Darwin judged the fitness of an individual by
    a) ability to defend itself.
    b) strategy to obtain food.
    c) number of offspring.
    d) dominance over other individuals.

41. Vitamin-K deficiency causes
    a) Scurvy
    b) Bleeding
    c) Osteomalacia
    d) None of the above

42. Which one of the following enzymes digests protein in stomach?
    a) Trypsin
    b) Pepsin
    c) Erepsin
    d) None of the above

43. Which one of the following aromatic compounds will not exhibit isomerism?
    a) Benzene
    b) 2-chloro pyridine
    c) Pirymidine
    d) 1,4 dichloro benzene

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

45. In C_3 plants, the first stable product of photosynthesis during the dark reaction is
    a) Malic acid
    b) Oxaloacetic acid
    c) 3-phosphoglyceric acid
    d) Phosphoglyceraldehyde

46. Law of limiting factor was given by
    a) Leibig
    b) Blackman
    c) Calvin
    d) A.R.Wallace

47. Which one of the following metals causes harmful effects?
    a) Lead
    b) Cobalt
    c) Uranium
    d) All of the above

48. The process of decay of dead organic matter is known as
    a) Denitrification
    b) Nitrification
    c) Ammonification
    d) Nitrogen fixation

49. An instrument for measuring atmospheric humidity as well as amount of water transpired is called
    a) Potometer
    b) Porometer
    c) Psychrometer
    d) Hydrometer

50. For nitrogen fixation in soil, a useful pigment is called
    a) Nitrogenise
    b) Haemoglobin
    c) Myoglobin
    d) Leghaemoglobin

51. Water holding capacity of soil is greater in
    a) Sandy soil
    b) Sandy loam
    c) Clay soil
    d) Silty soil

52. The molarity of pure water is
    a) 18 M
    b) 45.6 M
    c) 50 M
    d) 55.6 M

53. Heating of rubber with sulphur is known as
    a) Galvanisation
    b) Vulcanisation
    c) Bessemerisation
    d) Sulphonation

54. The reaction $H_2S + H_2O_2 \longrightarrow S + 2H_2O$ shows
    a) Acidic nature of H_2O_2
    b) Alkaline nature of H_2O_2
    c) Oxidising nature of H_2O_2
    d) Reducing nature of H_2O_2

55. When the body is rapidly oxidising fats, excess ketone bodies accumulate resulting in
    a) Pyruvic acid
    b) Lactic acid
    c) Ketoacidosis
    d) ATP

56. Uricotelic mode of passing out nitrogenous waste is found in
    a) reptiles and birds.
    b) birds and annelids.
    c) amphibians and reptiles.
    d) insects and amphibians.

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

58. Which one of the following helps in blood coagulation?
    a) Leucocytes
    b) Monocytes
    c) Lymphocytes
    d) Thrombocytes

59. Bleaching powder is obtained by the interaction of Cl_2 and
    a) Dilute solution of $Ca(OH)_2$
    b) Concentrate solution of $Ca(OH)_2$
    c) Dry CaO
    d) Dry slaked lime

60. Desired improved varieties of economically useful crops are raised by
    a) Vernalization
    b) Biofertilizers
    c) Hybridisation
    d) Natural selection

61. The type of placenta found in human beings is called
    a) Diffuse
    b) Zonary
    c) Cotyledonary
    d) Discoidal

62. Which one of the following gives positive Fehling's solution test?
    a) Protein
    b) Sucrose
    c) Glucose
    d) Fats

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

64. In ice-water-water vapour system, the degree of freedom is
    a) One
    b) Two
    c) Three
    d) None (Zero)

65. Which of the following is correctly matched?
    a) Pisciculture – Silk moth
    b) Apiculture – Honeybee
    c) Sericulture – Fish
    d) Aquaculture – mosquitoes

66. For the quick and sharp separation of the components of a mixture, the chromatography used is
    a) Paper chromatography
    b) Thinlayer chromatography
    c) Column chromatography
    d) Gas-liquid chromatography

67. Which one of the following elements occurs in the free state?
    a) Si
    b) Ge
    c) C
    d) Sn

68. Crossing of unrelated pure breeding animals of different traits within the same breed is called
    a) Close breeding
    b) Out crossing
    c) Cross breeding
    d) Species hybridisation

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

70. Photochemical reactions in the chloroplasts are directly involved in
    a) fixation of carbon dioxide.
    b) synthesis of glucose and starch.
    c) formation of phosphoglyceric acid.
    d) photolysis of water and phosphorylation of ADP to ATP.

Part II

Short Answer Questions [30 marks]

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

1. Absorption of water and minerals in the plants' cells is facilitated by different methods.
    a) List four different methods of absorptions. (2 marks)
    b) There are two major types of transport proteins in relation to one of the absorption method. What are they? (1 mark)

2. Give reasons for the following:
    a) Venous blood is more acidic than arterial blood. (2 marks)
    b) Earthworms come out of their burrows on heavy rains. (1 mark)

3. What mass of sodium chloride is present in 500 ml of NaCl with 2.00 M solution? (3 marks)

4. In plant growth and developmental study, C/N is crucial. What is C/N ratio? Describe its role. (3 marks)

5. Why do X-rays and gamma rays induce mutation? (3 marks)

6. There is greater biodiversity in tropical and sub-tropical regions then in temperate region. Explain. (3 marks)

7. The chemical equation given below shows the hydrolysis of cane sugar in aqueous solution in the presence of mineral acid.

$$C_{12}H_{22}O_{11} + H_2O + [H_2SO_4] \longrightarrow$$

   a) Complete the equation on the product side. What are the products formed? (2 marks)

   b) Of the three reactants in the equation, which reactant acts as a catalyst? (1 mark)

8. What does the term "memory" of immune system mean? (3 marks)

9. Explain the following terms with reference to the use of pesticides:

   (a) Bioconcentration (1.5 marks)

   (b) Biomagnification (1.5 marks)

10. Atmospheric air contains 79% nitrogen which is an essential plant nutrient but majority of plants obtain nitrogen from soil. Why? (3 marks)

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