ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2021
EXAMINATION CATEGORY: TECHNICAL

PAPER II: GENERAL SUBJECT KNOWLEDGE PAPER FOR BIO SCIENCE

Date : October 30, 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. In plants, the guard cells differ from other epidermal cells in having
   a) Cytoskeleton
   b) Mitochondria
   c) Chloroplasts
   d) Endoplasmic Reticulum

2. Heartwood differs from sapwood in
   a) presence of rays and fibres.
   b) absence of vessels and parenchyma.
   c) being susceptible to pest and pathogens.
   d) having dead and nonconducting elements.

3. In studying circulation in human, it is found that maximum amount of oxygen is lost from the blood in the
   a) capillaries surrounding the tissue cells.
   b) aeteries of the body.
   c) capillaries surrounding the alveoli.
   d) left auricle of the heart.

4. From outer to inside, the sequence of three bones present in the middle ear of mammals is
   a) Malleus, stapes and incus.
   b) Stapes, malleus and incus.
   c) Malleus, incus and stapes.
   d) Incus, malleus and stapes.

5. IUPAC name of C_2H_5CN is
   a) Ethyl cyanide
   b) Propane nitrile
   c) Acetonitrile
   d) Ethane nitrile

6. As the atomic number of halogens increases, the halogens
   a) gain electrons less readily.
   b) become less dense.
   c) loss the outermost electrons less readily.
   d) become lighter in colour.

7. About 70% of the total global carbon is found in
   a) Grasslands
   b) Agro-ecosystems
   c) Forests
   d) Oceans

8. A free-living aerobic and non-photosynthetic nitrogen-fixing bacterium is
   a) *Anabaena*
   b) *Clostridium*
   c) *Azotobacter*
   d) *Rhizobium*

9. Red phosphorus is less reactive than yellow phosphorus because
   a) it is red in colour.
   b) it is highly polymerised.
   c) it is hard.
   d) it is insoluble in C_2H_5OH.

10. Which one of the following is a systematic insecticide?
    a) Malathion
    b) Parathion
    c) Endrin
    d) Furadan

11. When a mutation is limited to the substitution of one nucleotide for another, it is called
    a) Translocation
    b) Base inversion
    c) Frameshift
    d) None of the above

12. An allotrope of phosphorus used in safety matches is
    a) White phosphorus
    b) Red phosphorus
    c) Black phosphorus
    d) Violet phosphorus

13. In an isothermal expansion of an ideal gas against a vacuum, the work involved is
    a) Zero
    b) Maximum
    c) Minimum
    d) Not equal to the heat absorbed by the system.

14. The total entropy change for a system and its surrounding increases, if the process is
    a) Reversible
    b) Irreversible
    c) Exothermic
    d) Endothermic

15. The hormone that increases the blood calcium level in human and decreases its excretion by kidney is
    a) Parathormone
    b) Calcitonin
    c) Thyroxine
    d) Insulin

16. Haemoglobin is having maximum affinity with
    a) Carbon dioxide
    b) Carbon monoxide
    c) Oxygen
    d) Ammonia

17. When ice melts into water, entropy
    a) becomes zero.
    b) decreases.
    c) increases.
    d) remains the same.

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

19. The pigment involved in photomorphogenetic movement is
    a) Cytochrome
    b) Phytochrome
    c) Chromatin
    d) Vernalin

20. If flowers are cut and dipped in dilute NaCl solution, then
    a) transpiration is low.
    b) endosmosis occurs.
    c) no bacterial growth takes place.
    d) absorption of solute inside flower cell takes place.

21. A taxon, which is facing an extremely high risk of extinction in the wild in immediate future is known as
    a) Rare
    b) Exotic
    c) Endangered
    d) Vulnerable

22. The correct sequence of layers found in root anatomy is
    a) Epiblema, cortex, endodermis, pericycle.
    b) Cortex, epiblema, endodermis, pericycle.
    c) Endodermis, pericycle, cortex, epiblema.
    d) Cortex, epiblema, endodermis, epidermis.

23. Radioactive disintegration differs from a chemical change in being
    a) a nuclear process.
    b) an exothermic process.
    c) a spontaneous process.
    d) a unimolecular first order reaction.

24. 10 g of NaCl is dissolved in 10^6 g of the solution. Its concentration is
    a) 0.1 ppm
    b) 1 ppm
    c) 10 ppm
    d) 100 ppm

25. Lignifications is associated with
    a) Xylem
    b) Phloem
    c) Parenchyma
    d) Chlorenchyma

26. The conversion of nitrate to nitrogen is called
    a) Nitrification
    b) Denitrification
    c) Nitrogen fixation
    d) Ammonification

27. Which of the following structures represents female gametophyte?
    a) Endosperm
    b) Ovule
    c) Embryo sac
    d) Embryo

28. The principal nitrogenous excretory compound in humans is synthesised
    a) in kidneys but eliminated mostly through liver.
    b) in kidneys as well as eliminated by kidneys.
    c) in liver and also eliminated by the same through bile.
    d) in liver but eliminated mostly through kidneys.

29. The molar solution of H_2SO_4 is equal to
    a) N/2 solution
    b) N solution
    c) 2N solution
    d) 3N solution

30. What is the molarity of 0.2 N Na_2CO_3 solution?
    a) 0.05 M
    b) 0.4 M
    c) 0.1 M
    d) 0.2 M

31. Blood platelets are found only in the blood of
    a) Birds
    b) Reptiles
    c) Amphibians
    d) Mammals

32. "Organ of Jacobson" helps in
    a) Touch
    b) Vision
    c) Smell
    d) Hear

33. If mammalian ovum fails to get fertilised, which one of the following is unlikely?
    a) Corpus luteum will disintegrate.
    b) Primary follicle starts developing.
    c) Estrogen secretion further decreases.
    d) Progesterone secretion rapidly declines.

34. The Volume of 0.6 M NaOH required to neutralise 30 cm^3 of 0.4 M HCl is
    a) 20 cm^3
    b) 30 cm^3
    c) 40 cm^3
    d) 50 cm^3

35. The reaction of acetamide with water is called
    a) Alcoholysis
    b) Ammonolysis
    c) Hydrolysis
    d) Sponification

36. Lactose is disaccharide of
    a) Glucose and fructose.
    b) Glucose and glucose.
    c) Glucose and maltose.
    d) Glucose and galactose.

37. Which carbohydrate is essential constituent of plant cell?
    a) Starch
    b) Cellulose
    c) Glucose
    d) Sucrose

38. The enzyme responsible for reduction of molecular nitrogen to the level of ammonia in the leguminous root nodules is
    a) Amminase
    b) Nitrate reductase
    c) Nitrogenase
    d) Nitrite reductase

39. The isomers have the same
    a) Structural formula
    b) Chemical properties
    c) Physical properties
    d) Molecular formula

40. The elements that make up 99% of all elements found in living system are
    a) C, H, O
    b) C, H, O, N
    c) C, H, O, N, P
    d) C, H, O, P

41. What type of carbohydrate is cane sugar?
    a) Monosaccharide
    b) Disaccharide
    c) Trisaccharide
    d) Polysaccharide

42. During depression of freezing point in a solution, which of the following are in equilibrium?
    a) Liquid solvent, solid solvent
    b) Liquid solvent, solid solute
    c) Liquid solute, solid solvent
    d) None of the above

43. Which part of our body secrets the hormone secretin?
    a) Ileum
    b) Stomach
    c) Duodenum
    d) Oesophagus

44. The bond angle in water is
    a) 90^o
    b) 105^o
    c) 107^o
    d) 120^o

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

46. The pH of a solution is 5.9. If the hydrogen ion concentration is decreased hundred times, the solution will be
    a) More acidic
    b) Neutral
    c) Basic
    d) Of the same acidity.

47. Which of the following species are restricted to an area?
    a) Sibling species
    b) Endemic species
    c) Allopatric species
    d) Sympatric species

48. Which one of the following is against the theory of ascent of sap given by Dixon and Jolly?
    a) Cohesion force of water molecules.
    b) Adhesive force of water molecules.
    c) Requirement of ATP.
    d) None of the above.

49. Which of the following is not a purpose of transpiration?
    a) Supplies water for photosynthesis.
    b) Helps in translocation of sugars from source to sink.
    c) Maintains shape and structure of the plants.
    d) Transports minerals from the soil to all parts of the plant.

50. NH_3 dissolves in H_2O to give NH_4OH. In this reaction water acts as
    a) an acid.
    b) a base.
    c) a salt.
    d) a conjugate base.

51. When a buffer solution of CH_3COONa and CH_3COOH is diluted with water, then
    a) H^+ ion concentration increases.
    b) H^+ ion concentration decreases.
    c) H^+ ion concentration remains constant.
    d) CH_3COO^- ion concentration increases.

52. In human female, menstruation can be deferred by the administration of
    a) FSH only.
    b) LH only.
    c) Combination of FSH and LH.
    d) Combination of estrogens and progesterone.

53. What makes a lemon sour?
    a) Oxalic acid
    b) Tartaric acid
    c) Citric acid
    d) Hydrochloric acid

54. Formic acid is prepared by heating oxalic acid with
    a) Glycol
    b) Glycerol
    c) Glycine
    d) Acetic anhydride

55. Which of the following scientist's name is correctly matched with the theory put forth by him?
    a) Weismann – Theory of continuity of germplasm.
    b) Pastuer – Inheritance of acquired characters.
    c) De Vries – Natural selection.
    d) Mendel – Theory of pangenesis.

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

57. Pineal gland of human brain secrets melatonin concerned with
    a) Anger
    b) Body temperature
    c) Sleep
    d) Colouration of skin

58. Lower carboxylic acids are soluble in water due to
    a) Low molecular weight.
    b) Dissociation into ions.
    c) H-bonding.
    d) Easy hydrolysis.

59. Bacterium *Pseudomonas* is useful as it can
    a) fix atmospheric nitrogen.
    b) decompose a variety of organic compounds.
    c) produce several antibodies.
    d) None of the above.

60. Blood dialyser works on the physical laws of
    a) Imbibitions and osmosis.
    b) Plasmolysis.
    c) Imbibitions and diffusion.
    d) Diffusion and osmosis.

61. Which pair is essential for the growth of fish in water?
    a) Nitrates and sulphates
    b) Sulphanates and carbonates
    c) Calcium and phosphate
    d) Carbonates and phosphates

62. In malaria, the product released by mosquitoes into blood that causes chill and fever is called
    a) Haematin
    b) Schuffner's dots
    c) Haematoxin
    d) Haemazoin

63. Status of Red Panda is
    a) Critically endangered
    b) Endangered
    c) Vulnerable
    d) Extinct

64. Leaf abscission is caused by
    a) Auxin
    b) ABA
    c) Gibberellins
    d) Cytokinin

65. In thermodynamics, a process is called reversible when
    a) surroundings and system change into each other.
    b) there is no boundary between system and surroundings.
    c) the surroundings are always in equilibrium with the system.
    d) the system changes into the surroundings spontaneously.

66. In some plants, anthers and stigma grow and mature at the same time. This phenomenon is called
    a) Homogamy
    b) Allogamy
    c) Syngamy
    d) Fusion

67. 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.

68. The minerals involved in water-splitting reaction during photosynthesis are
    a) Magnesium and chlorine
    b) Potassium and manganese
    c) Manganese and chlorine
    d) Copper and chlorine

69. The C_4 plants are photosynthetically more efficient than C_3 plants because of
    a) the higher leaf area.
    b) the presence of more chloroplasts.
    c) the lower rate of photorespiration.
    d) the carbon dioxide efflux is not prevented.

70. The 'Eyes' of the potato tuber are
    a) Root buds
    b) Shoot buds
    c) Flower buds
    d) Axillary buds

Part II

Short Answer Questions [30 marks]

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

1. Plants have chlorophyll *a* which is the primary pigments for light reaction but they also have others called as accessory pigments.
    a) What are the accessory pigments? (1.5 mark)
    b) What are the roles of accessory pigments in photosynthesis? (1.5 marks)

2. What is the difference between saprophytic and saprozoic nutrition? (3 marks)

3. Terrestrial animals are generally either ureotelic or uricotelic and not ammonotelic. Why? (3 marks)

4. What is the molarity of an aqueous solution of ethanoic acid (CH_3COOH), which contains 6.0 g of ethanoic acid in 500 ml of the solution? (3 marks)

5. Explain antibiotic resistance observed in bacteria in light of Darwinian's selection theory. (3 marks)

6. In dim light, you can see better by looking through the corner of eye. Why? (3 marks)

7. Biological clocks help organisms to maintain adaptive behaviour. Give two examples to justify that circadian rhythmic behaviour in plant is adaptive in nature. (3 marks)

8. Define a term polymer. Give the names of one natural polymer and one synthetic polymer. Mention the monomers present in them. (3 marks)

9. The probability of fruit set in a self-pollinated bisexual flower of a plant is far greater than a dioecious plant. Explain. (3 marks)

10. A transverse section of a tree trunk shows concentric dark and light coloured rings.
    a) What are these rings called? (1 mark)
    b) Why are dark and light coloured rings of different thickness? (2 marks)

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