Civil Services (Main) Examination, 2015

ZOOLOGY
(Paper II)

Time Allowed : Three Hours **Maximum Marks : 250**

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.
Candidate has to attempt FIVE questions in all.
Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.
The number of marks carried by a question/part is indicated against it.
Wherever any assumptions are made for answering a question, they must be clearly indicated.
Word limit in questions, wherever specified, should be adhered to.
Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

SECTION 'A'

1. (a) List and illustrate the components of biological membranes in terms of their arrangement, role in the maintenance of feudicity, permeability and signal reception and translation. **10**

(b) Arrange the sequential enzymatic participations in DNA replication. Describe their specific role in each step. **10**

(c) Define operon. Give the similarities and differences between tryptophan and arabinose operon, with a focus on attenuation. **10**

(d) What is mutagenesis? Explain with diagrams how mutagens cause genetic changes. **10**

(e) Narrate with suitable examples the use of ribozymes in health care and agriculture. **10**

2. (a) What are Rb and P^{53} proteins? How do they regulate the cell cycle? How do they protect the cell from carcinogenesis? **15**

(b) Illustrate the different theories regarding the origin of life with special reference to protein evolution. **20**

(c) Define the characters of DNA vectors. Explain with diagrams how these vectors function in a variety of situations. **15**

3. (a) "Isolation is the key factor in evolution." Justify the statement giving suitable examples from geographical and reproductive isolation. **15**

(b) Give the characteristic features of ancestors of elephants and give progressive evolutions that have occurred during various geological times resulting in the emergence of the modern day elephant. **20**

(c) Define mimicry. How does it occur? How has mimicry evolved in the animal kingdom? Give examples. **15**

4. (a) The Genotype of the parent is as under:

$$2n+XhY \times 2n+X_0xh$$

Indicate the type of Gametes that will be formed and character represented by their Offsprings. Also indicate whether the parents are carriers or free from disorder. Find out: (i) Percentage of carriers. (ii) Percentage of haemophilic sons and daughters. (iii) Percentage of normal offsprings. Why does haemophilia occur? Give the symptoms of haemophilia. How is haemophilia genetically inherited? **20**

English version compiled from published transcriptions and cross-checked across sources; not a facsimile of the official UPSC question paper.

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(b) What are giant chromosomes? Name them. State their locations and illustrate their structures. How do they function? **15**

(c) What is ICZN? Explain the principle, scope and limitations in the present day scenario of nomenclature. **15**

SECTION 'B'

5. (a) Describe with suitable diagrams the role of G-protein in the synthesis of C-AMP. Demonstrate how C-AMP activate protein kinase. **10**

(b) What are vitamins and co-enzymes? Describe fat soluble vitamins with examples. **10**

(c) Label the figure and answer the following questions: (i) Name the parts. (ii) Name the inner ossicles. (iii) Name the parts of cochlea. (iv) What is the organ of corti? (v) What are the steps by which sound waves at the ear drum cause impulse generation in the cells of organ of corti?

[Figure: Unlabelled diagrammatic vertical section of the mammalian (human) ear showing the external auditory canal, middle ear and inner ear, with numbered pointers 1–16 (to be named). Two dashed oblique lines run down from the upper left towards the middle ear; small double-headed arrows mark vibration of the ear drum and ossicles. Pointer 1: the external ear canal at the left (lumen leading to the ear drum). Pointer 2: the ear drum (membrane closing the inner end of the canal). Pointer 3: two leaders to the looped semicircular canals at the top. Pointer 4: a thin curved line from the upper right running to the vestibule (the nerve of the inner ear). Pointer 5: the sac-like chamber (vestibule) at the base of the semicircular canals. Pointer 6: the junction of the innermost ossicle with the inner ear (oval window region). Pointer 7: a rounded swelling just below the vestibule beside the base of the cochlea (round window region). Pointer 8: the stippled channel at the base of the cochlea, just below the oval window region, leading into the cochlear coil. Pointer 9: the coiled cochlea (outer coil). Pointer 10: the inner (upper) channel of the cochlear coil. Pointer 11: the outer (lower), stippled channel of the cochlear coil. Pointer 12: the bony region surrounding the cochlea at the lower right. Pointer 13: the long tube running obliquely down to the lower right (bottom margin of the figure). Pointers 14, 15 and 16: vertical leaders from below to the three middle-ear ossicles – 16 to the outermost (attached to the ear drum), 15 to the middle one, 14 to the innermost (fitting into the opening of the inner ear).] **10**

(d) Differentiate between saturated and unsaturated fatty acids and their functions. **10**

(e) Differentiate between Innate and Adaptive immunity. Justify your answer with suitable examples. **10**

6. (a) Explain with diagrams the molecular mechanism of contraction of skeletal muscles. Discuss the role of ions and bioenergetics in muscle contraction. Attribute the cause(s) for muscle cramps. **20**

(b) What is metamorphosis? Differentiate between retrogressive and progressive metamorphosis, with figures and examples. How are they regulated? **15**

(c) Define hormones. Distinguish between Steroid and Peptide hormones. Give the name of the hormones and its mechanism of action that uses Ca^{+2} and/or Calcitonin as second messenger. **15**

7. (a) What are caspase enzymes? Narrate their crucial role in cell death. **15**

(b) Differentiate between totipotent and multipotent cells with suitable examples. Explain the use of stem cells in human diseases. **20**

(c) What is an active site? How does enzyme catalysis take place in an active site? Explain with suitable examples. **15**

8. (a) Label the parts of nephron and answer the following questions: (i) Which region of the kidney contains malpighian body, loop of Henle and collecting ducts? (ii) What is Glomerular filtration rate? (iii) Write the steps of urine formation. (iv) What is the effect of vasopressin, oxytocin and aldosterone in renal function? (v) What is the holding capacity of urinary bladder in man and the term used for the discharge of urine?

[Figure: Unlabelled diagram of nephrons with their blood supply, numbered pointers 1–15 (to be named). At the left two parallel vertical blood vessels with downward arrow 14 (left vessel, flow down) and upward arrow 15 (right vessel, flow up). A horizontal dashed line across the figure marks the boundary between the outer (upper) **20**

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and inner (lower) regions of the kidney. Upper (cortical) nephron: pointer 1 – the vessel branching from the left vessels towards the capillary tuft, with an arrow showing flow towards it; pointer 2 – the capillary tuft (glomerulus); pointer 3 – the cup-shaped capsule around it; pointer 4 – the vessel leaving the tuft; pointer 5 – the coiled tubule next to the capsule, covered by a network of capillaries; pointer 6 – a second coiled tubule (upper right) joining a vertical duct; pointer 7 – the point near the bottom of the coiled tubules where the tubule and a vessel meet (below the coils). A long vessel with an arrow returns to the left vessels. Pointer 8 – the vertical branched duct at the right receiving tubules. A lower nephron (near the dashed line) has its own capillary tuft and capsule, a vessel with arrows, and long hairpin loops descending below the dashed line. Pointer 9 – two leaders to the outer vessel loop surrounding the long hairpin loop; pointers 10, 11, 12 and 13 – the limbs of the long hairpin loops in the lower region (13 and 12 on the left/descending side, 11 and 10 on the right/ascending side, inner and outer).]

(b) Explain the role of salivary glands, liver, pancreas and intestinal glands in fat and carbohydrate digestion. **15**

(c) Which stage of the development is used to produce the transgenic animals? How is it done? **15**

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