

Biology, 1996 EC, entrance exam, booklet 43

Grade 12 · Biology · 1996 E.C.

MARKING KEY — CONFIDENTIAL

Time allowed: 120 minutes

Questions: 49

Total marks: 49

1. Select the type of behavior which is innate. (1)
- A. ✓ **Reflex action** B. Habituation
C. Conditioning D. Imprinting

Answer: A

Reflex actions are rapid, involuntary, and automatic responses to stimuli that are fully programmed genetically (innate), unlike habituation, conditioning, and imprinting, which involve learning.

2. Select the field of biology that is concerned with the study of cells. (1)
- A. Histology B. Morphology
C. ✓ **Cytology** D. Ecology

Answer: C

Cytology is the branch of biology concerned with the structure and function of plant and animal cells, whereas histology is the study of tissues.

3. Which ecological interaction between two species results in a negative effect on both organisms? (1)
- A. Mutualism B. ✓ **Competition**
C. Predation D. Neutralism

Answer: B

Competition is an interaction where both species are harmed (-/-) because they contend for the same limited resources, such as food, water, or territory.

4. Which cellular structures are responsible for autolysis or self-digestion? (1)
- A. Chromosomes B. Ribosomes
C. ✓ **Lysosomes** D. Golgi apparatus

Answer: C

Lysosomes contain hydrolytic enzymes that break down waste materials and cellular debris; when a cell is damaged, lysosomes can rupture and digest the entire cell (autolysis).

5. What is the energy currency of the cell? (1)
- A. DNA B. Glucose
C. Starch D. ✓ **ATP**

Answer: D

Adenosine triphosphate (ATP) is known as the energy currency of the cell because it stores and releases usable chemical energy for cellular processes.

6. At which stage of cell division do homologous chromosomes line up at the equatorial plane of the cell? (1)
- A. Prophase
B. ✓ **Metaphase**
C. Anaphase
D. Telophase

Answer: B

During metaphase (specifically metaphase I of meiosis), chromosomes align along the cell's equator (metaphase plate) before being separated.

7. Which one of the following unicellular organisms is prokaryote? (1)
- A. Amoeba
B. ✓ **Bacteria**
C. Euglena
D. paramecium

Answer: B

Bacteria are unicellular organisms that lack a membrane-bound nucleus and organelles, classifying them as prokaryotes, unlike eukaryotic protists like Amoeba, Euglena, and Paramecium.

8. Which of the following is a postzygotic reproductive isolating mechanism? (1)
- A. Seasonal isolation
B. ✓ **Hybrid sterility**
C. Mechanical isolation
D. Geographic isolation

Answer: B

Hybrid sterility (where the offspring of two different species is healthy but cannot reproduce, like a mule) occurs after fertilization, making it a postzygotic isolating mechanism.

9. Which of the following cells is diploid? (1)
- A. Egg
B. sperm
C. Second polar body
D. ✓ **Zygote**

Answer: D

A zygote is formed by the fusion of a haploid egg and a haploid sperm, resulting in a diploid ($2n$) cell with two sets of chromosomes.

10. To which one of the following groups of organic molecules do enzymes belong? (1)
- A. Carbohydrates
B. Lipids
C. ✓ **Proteins**
D. Nucleic acids

Answer: C

Enzymes are biological catalysts, and nearly all enzymes are highly folded, specific protein molecules.

11. Choose the animal group that is represented in Ethiopia by a higher proportion of endemic species in relation to the total number of species of that animal group found in the country. (1)
- A. Birds
B. Reptiles
C. ✓ **Amphibians**
D. Fishes

Answer: C

Among the vertebrate classes in Ethiopia, amphibians have the highest proportion of endemic species relative to the total number of amphibian species recorded in the country (about 30–40% are endemic).

12. Which term applies to the rearing of fish under more or less controlled conditions? (1)

- A. Apiculture
- B. ✓ **Pisciculture**
- C. Silviculture
- D. Aquaculture

Answer: B

Pisciculture specifically refers to the controlled breeding and rearing of fish, whereas aquaculture is a broader term that includes farming of all aquatic organisms (like shellfish and algae).

13. Which of the following is the middle layer of an embryo? (1)

- A. Neural plate
- B. Ectoderm
- C. ✓ **Mesoderm**
- D. Endoderm

Answer: C

During embryonic development, the mesoderm forms as the middle germ layer, sandwiched between the outer ectoderm and the inner endoderm.

14. Based on our mode of nutrition, to which of the following groups do we humans belong? (1)

- A. ✓ **Omnivores**
- B. Carnivores
- C. Herbivores
- D. Autotrophs

Answer: A

Humans naturally consume both plant- and animal-derived foods, classifying us as omnivores.

15. What is the best term used to refer to the association of different species of organisms interacting and living together? (1)

- A. Ecosystem
- B. ✓ **Community**
- C. Pyramid
- D. Niche

Answer: B

An ecological community consists of all the populations of different species living and interacting together within a defined geographic area.

16. Choose the one that represents anabolic reaction (1)

- A. Deamination
- B. ✓ **Photosynthesis**
- C. Digestion
- D. Aerobic respiration

Answer: B

Photosynthesis is an anabolic process because it builds complex energy-rich glucose molecules from simpler inorganic molecules (carbon dioxide and water).

17. What is a plasmid? (1)

- A. Material that is found in blood
- B. Material found in the cell membrane
- C. The same as a virus
- D. ✓ **A strand of DNA in bacteria cell**

Answer: D

A plasmid is a small, circular, double-stranded DNA molecule that is distinct from a cell's chromosomal DNA, commonly found in bacteria.

18. Which type of dominance operates when it is known that both alleles of a gene contribute to the features of the phenotype? (1)

- A. Complete dominance
- B. Incomplete dominance
- C. ✓ **Codominance**
- D. Intermediate dominance

Answer: C

In codominance, both alleles are fully expressed in the phenotype of the heterozygote, meaning both alleles contribute distinct features to the phenotype (e.g., AB blood type).

19. If tissues from sliced potato tuber are kept in sea water which of the following is more likely to happen? (1)

- A. The cells will take up water and burst
- B. ✓ **The cells lose water and become flaccid**
- C. The cells become dry and impermeable.
- D. The cells actively pump out salts

Answer: B

Sea water is hypertonic relative to the cytoplasm of potato cells, causing water to leave the potato cells by osmosis, which results in plasmolysis and flaccidity.

20. To which of the following properties of life does the term irritability refer? (1)

- A. Excretion
- B. ✓ **Response to stimulus**
- C. Homeostasis
- D. Metabolism

Answer: B

Irritability, also known as sensitivity, is the characteristic of living organisms to perceive external or internal stimuli and respond to them appropriately.

21. From which of the following do scientists usually formulate a hypothesis? (1)

- A. ✓ **Observation**
- B. Prediction
- C. Theory
- D. Experiment

Answer: A

The scientific method typically starts with observations, from which scientists formulate a testable hypothesis to explain those observations.

22. Select the alternative that contains only vector borne infections. (1)

- A. Malaria, Trachoma, Syphilis, Tapeworm
- B. ✓ **Malaria, Leishmaniasis, Trypanosomiasis, Typhus**
- C. Diphtheria, Tuberculosis, Cholera, Meningitis
- D. Leprosy, Ringworm, Pneumonia, Hookworm

Answer: B

The diseases in this option are all transmitted by vectors: Malaria (mosquitoes), Leishmaniasis (sandflies), Trypanosomiasis (tsetse flies), and Typhus (lice).

23. Which of the following groups probably ate more of a herbivorous diet? (1)

- A. Homo erectus
- B. Homo habilis
- C. Cromagnon humans
- D. ✓ **Australopithecus afarensis**

Answer: D

Australopithecus afarensis lived earlier and possessed dental adaptations (such as thick enamel and large molars) suited for grinding fibrous plant materials, eating a much higher proportion of vegetation than later Homo species.

24. Which new research technique was used to produce the new plant now known as the "pomato"? (1)
- A. Genetic engineering B. ✓ **Protoplast fusion**
C. Sexual hybridization D. Inbreeding

Answer: B

The "pomato" is a somatic hybrid produced by protoplast fusion, where the cell walls of potato and tomato cells are removed and their protoplasts are fused to regenerate a hybrid plant.

25. To which trophic level do green plants belong? (1)
- A. Zero B. ✓ **First**
C. Second D. Third

Answer: B

As primary producers that synthesize their own food using sunlight, green plants occupy the very first trophic level of any ecosystem.

26. If an F_1 round yellow pea of $R_r Y_y$ genotype is selfed, which class of pea is the most frequent in the F_2 generation? (1)
- A. Wrinkled green B. Round green
C. Wrinkled yellow D. ✓ **Round yellow**

Answer: D

In a dihybrid cross of a selfed $R_r Y_y$ heterozygote, the expected phenotypic ratio in the F_2 generation is 9:3:3:1, where the double dominant phenotype (Round yellow) is the most frequent at 9/16.

27. Which property of water keeps lake-inhabiting organisms from freezing in winter in cold regions like the Arctic region? (1)
- A. High latent heat of vaporization B. High heat of fusion
C. High surface tension D. ✓ **Low density of the solid state**

Answer: D

Water is unique because its solid state (ice) is less dense than its liquid state, causing ice to float on top of lakes. This surface ice layer acts as an insulator, keeping the liquid water underneath from freezing and allowing aquatic life to survive the winter.

28. Which of the following enzymes has its optimum pH within low pH range? (1)
- A. ✓ **Pepsin** B. Salivary amylase
C. Pancreatic lipase D. Catalase

Answer: A

Pepsin is an enzyme found in the stomach that functions best in a highly acidic environment, with an optimum pH of about 1.5 to 2.0.

29. Suppose an archeologist discovered remains of plant material which contains one-eighth of its original content of carbon-14. If the half-life of carbon-14 is 5600 years, how old is the plant material? (1)
- A. 50,000 years B. 28,000 years
C. ✓ **16,800 years** D. 11,200 years

Answer: C

A remaining fraction of one-eighth ($1/8 = (1/2)^3$) indicates that exactly three half-lives have elapsed. Multiplying 3 half-lives by 5600 years per half-life gives an age of 16,800 years.

30. Which of the following happens during the dark reaction of photosynthesis? (1)

- A. ATP is produced
B. NADPH is produced
C. Oxygen is split from water
D. ✓ **Carbon dioxide is fixed**

Answer: D

During the light-independent (dark) reactions or the Calvin cycle, carbon dioxide is fixed into organic molecules using ATP and NADPH produced during the light reactions.

31. Which enzyme is used in textile industry to remove starch used in fabrics as adhesive or support during weaving? (1)

- A. Amyloglucosidase
B. Lipase
C. ✓ **Amylase**
D. Trypsin

Answer: C

Amylase is widely used in the textile industry for the desizing process to break down and remove starch, which is used as an adhesive to strengthen warp threads during weaving.

32. Which of the following crop species is NOT an oil crop? (1)

- A. Guizotia abyssinica
B. Arachis hypogaea
C. ✓ **Lens culinaris**
D. Sesamum indicum

Answer: C

Lens culinaris (lentil) is a legume (pulse) crop grown for its protein-rich seeds, unlike Guizotia abyssinica (noug), Arachis hypogaea (groundnut), and Sesamum indicum (sesame) which are primary oilseed crops.

33. Which two groups of organisms does the fossil animal known as *Archeopteryx* link? (1)

- A. ✓ Reptiles and birds** **B. Mammals and reptiles**
C. Reptiles and amphibians **D. Amphibians and fishes**

Answer: A

Archaeopteryx is a famous transitional fossil displaying a mix of reptilian features (such as teeth and a long bony tail) and avian features (such as feathers and wings), linking reptiles and birds.

34. During protein synthesis, which of the following molecules transports amino acids to their correct positions in the growing chain of polypeptide? (1)

- A. Messenger RNA
B. Deoxyribonucleic acid
C. Ribosomal RNA
D. ✓ **Transfer RNA**

Answer: D

Transfer RNA (tRNA) molecules carry specific amino acids to the ribosome, matching their anticodons with the codons on the messenger RNA (mRNA) to build the polypeptide chain.

35. If the protoplasm shrinks away from the cell wall when a plant cell is bathed in a sugar solution, what is the concentration of the solution relative to the protoplasm of the plant cell? (1)

- A. ☒ Hypertonic
B. Isotonic
C. Hypotonic
D. Isoosmotic

Answer: A

Plasmolysis, where the protoplasm shrinks away from the cell wall, occurs when a plant cell is placed in a hypertonic solution because water leaves the cell by osmosis down its concentration gradient.

36. What is the method of conservation in which animals are kept in captivity and plants are grown in botanical gardens? (1)
- A. In-situ conservation
 - B. Zoo conservation
 - C. ✓ **Ex-situ conservation**
 - D. Complementary in-situ and ex-situ conservation

Answer: C

Ex-situ conservation refers to the preservation of components of biological diversity outside their natural habitats, such as in zoos, botanical gardens, and seed banks.

37. In which region of Ethiopia would you look for an ecosystem dominated by lowland dry forests? (1)
- A. Afar region
 - B. ✓ **Somali region**
 - C. Gambella region
 - D. Southern region

Answer: B

The Somali region of Ethiopia is dominated by dry, lowland ecosystems characterized by Acacia-Commiphora woodlands and deciduous bushlands, which represent the major lowland dry forest type in the country.

38. A chimpanzee concentrates to reach at a bunch of grapes hanging above its head. What kind of behavior is this? (1)
- A. ✓ **Insight learning**
 - B. Latent learning
 - C. Associative learning
 - D. Sensitization learning

Answer: A

Insight learning involves solving a problem rapidly by understanding the relationships between various parts of the problem without trial-and-error, as famously demonstrated by primates solving tasks to reach food.

39. Which factor is least responsible for the reduction or loss of biodiversity in Ethiopia? (1)
- A. Over-harvesting biological resources
 - B. Climate change
 - C. ✓ **Human cultural diversity**
 - D. Commercial farming

Answer: C

Human cultural diversity is least responsible for biodiversity loss and often promotes conservation through indigenous knowledge, whereas habitat destruction from commercial farming, over-harvesting, and climate change are major drivers of loss.

40. In the life cycle of a moss plant, which of the following is diploid? (1)
- A. Gametophyte generation
 - B. ✓ **Sporophyte generation**
 - C. Protonema
 - D. Spores

Answer: B

In the life cycle of bryophytes like mosses, the gametophyte (including protonema and gametes) and spores are haploid (n), whereas the sporophyte generation is diploid ($2n$).

41. If a strand of DNA carrying AAT bases is copied to RNA what would the corresponding bases be in the RNA? (1)
- A. ✓ **UUA**
 - B. TTA
 - C. AAT
 - D. UUT

Answer: A

During transcription, adenine (A) pairs with uracil (U) in RNA, and thymine (T) pairs with adenine (A). Thus, a template DNA sequence of AAT is transcribed to UUA in RNA.

42. If the letter “d” is observed under a microscope, what would its image look-like? (1)
- A. Letter d itself
 - B. Letter b
 - C. Letter q
 - D. ✓ **Letter p**

Answer: D

A compound light microscope produces an image that is inverted both vertically and horizontally (rotated 180 degrees), turning a lowercase letter 'd' into a 'p'.

43. Which of the following best illustrates loss of biodiversity? (1)
- A. The death of an individual insect that belongs to a successful species
 - B. ✓ **A complex forest ecosystem is converted to a field of a modern high yielding crop variety**
 - C. A new plant species is introduced from a neighboring country and becomes part of the flora
 - D. A species develops a number of distinct varieties

Answer: B

Replacing a highly diverse, complex forest ecosystem with a monoculture of a single crop variety represents a drastic reduction in species richness and ecological complexity, indicating a major loss of biodiversity.

44. Choose the alternative that best illustrates the recombinant DNA technique. (1)
- A. Artificial insemination of animals
 - B. Crossing related plants to improve yield.
 - C. ✓ **Gene from one organism are introduced into the genome of an unrelated organism**
 - D. Crossing of carefully selected varieties of a species

Answer: C

Recombinant DNA technology involves combining DNA molecules from different species and inserting them into a host organism to produce new genetic combinations, such as transgenic organisms.

45. Which of the following diseases of animals would be controlled if one is able to control tsetse flies? (1)
- A. Heartwater
 - B. Rinderpest
 - C. ✓ **Trypanosomiasis**
 - D. Blackleg

Answer: C

Tsetse flies are the biological vectors of Trypanosoma parasites, which cause African trypanosomiasis (sleeping sickness in humans and nagana in livestock).

46. Suppose a couple produced a legitimate child of blood type B, what are the genotypes of the couple? (1)
- A. AA × BB
 - B. AA × AB
 - C. AA × BO
 - D. ✓ **AO × BO**

Answer: D

A child of blood type B must inherit at least one I^B allele. Among the choices, only the cross AO × BO can yield offspring with the BO genotype, which expresses as blood type B.

47. Which of the following techniques is employed in the transfer of human insulin gene to bacteria in order to produce human insulin in the bacteria? (1)
- A. DNA finger printing technique
 - B. Protoplast fusion technique
 - C. Cross pollination technique
 - D. ✓ **Recombinant DNA technique**

Answer: D

Recombinant DNA technique is used to splice the human insulin gene into bacterial plasmids, allowing the genetically modified bacteria to synthesize human insulin.

48. Suppose a man has a dominant gene on his X-chromosome, Which of his children would show the trait that is controlled by this gene? (1)
- A. All sons and daughter
 - B. All sons only
 - C. ✓ **All daughter only**
 - D. Half of the sons and half of the daughters

Answer: C

A father passes his X chromosome to all of his daughters and his Y chromosome to all of his sons; therefore, any trait determined by a dominant gene on his X chromosome will be expressed in all of his daughters and none of his sons.

49. In Ethiopia, which of the following genera of microorganisms has the potential to be used for single cell protein production? (1)
- A. ✓ **Spirulina**
 - B. Bacillus
 - C. Rhizobium
 - D. Agrobacterium

Answer: A

Spirulina is a genus of blue-green algae (cyanobacteria) that grows abundantly in Ethiopian alkaline lakes (like Lake Chitu) and is widely cultivated as a rich source of single-cell protein (SCP).

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