

CLASS XI
BIOLOGY (044)

Maximum Marks: 70

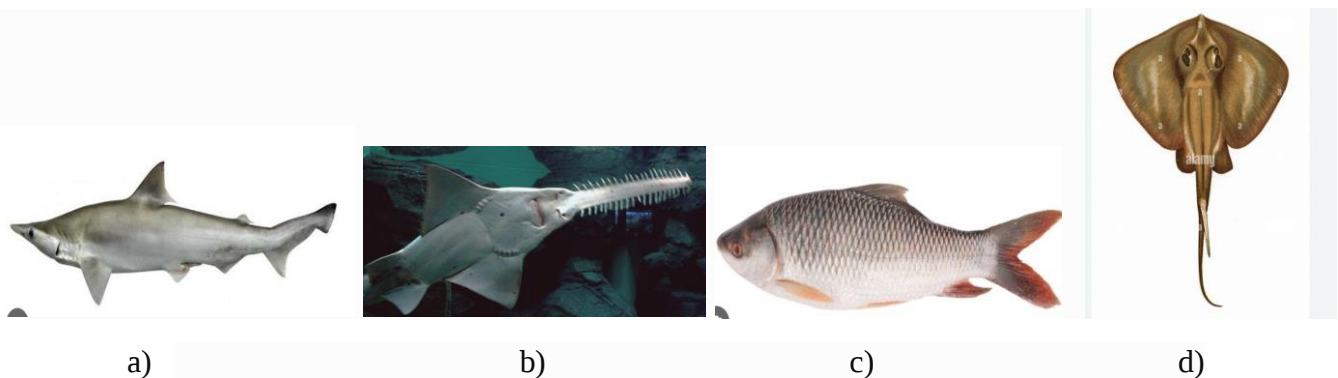
Time: 3 hours

General Instructions:

- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions.
- (iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section–C has 7 questions of 3 marks each; Section–D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
- (iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION A

1. Select the correct statement regarding viruses.
 - a) They are always considered living.
 - b) They are always considered non-living.
 - c) They show living characteristics only inside a host cell.
 - d) They perform metabolism outside a host.
2. A flower has a tricarpeillary, syncarpous ovary with 10 ovules in each carpel. Calculate the total number of ovules.
 - a) 10
 - b) 20
 - c) 30
 - d) 40
3. A person loses a large amount of water through sweating without replacing the lost fluids. Which hormone is expected to increase in secretion to conserve water?
 - a) Insulin
 - b) Thyroxine
 - c) ADH
 - d) Glucagon
4. A football player suddenly changes direction while running. Which component of the knee joint helps to minimise friction between the articulating surfaces?
 - a) Tendon
 - b) Ligament
 - c) Synovial fluid
 - d) Subcutaneous fat
5. Identify the fish that possesses an air bladder.



6. Choose the statements that are correct about Bidder's canal.

- i) It is present in the ovary of the female frog and enters the kidney through the oviduct.
- ii) It is present in the kidney of the male frog.
- iii) Vasa efferentia that arise from the testes enter the kidney and open into Bidder's canal.
- iv) Bidder's canal communicates with the urinogenital duct, which opens into the cloaca.

- a) i and ii. b) ii, iii and iv c) i, ii and iii d) iii and iv

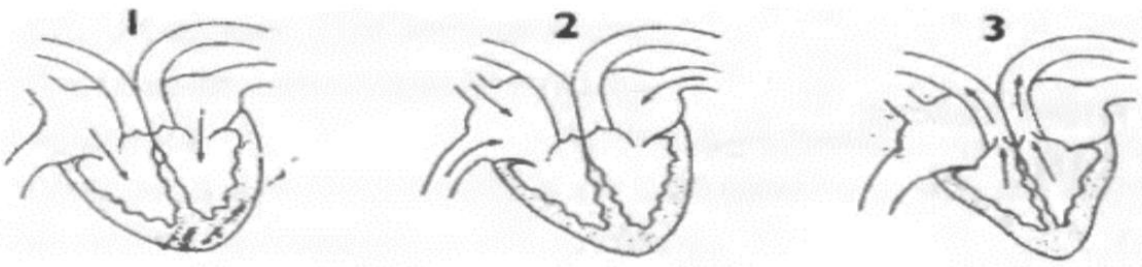
7. The group attached to the central alpha carbon that determines the chemical identity, polarity, and function of an amino acid is

- a) The amino group b) The hydrogen atom
- c) The carboxyl group d) The side chain (R group)

8. The primary function of the kinetochore during the eukaryotic cell cycle is

- a) Telomere length maintenance b) Ribosomal RNA synthesis
- c) Spindle microtubule arrangement d) DNA replication initiation.

9. The following diagrams show three stages in the cardiac cycle. Select the correct sequence-



- a) 2,3,1 b) 1,2,3 c) 2,1,3 d) 3,1,2

10. When a neuron is not conducting any impulse, the axonal membrane is:

- a) More permeable to K^+ than to Na^+
- b) More permeable to Na^+ than to K^+
- c) Equally permeable to K^+ and Na^+
- d) Impermeable to both K^+ and Na^+

11. A student measures the gases exchanged during respiration in a tissue and records the following:

Oxygen consumed = 10 mL

Carbon dioxide released = 7 mL

Which of the following is the most likely respiratory substrate?

- a) Carbohydrates b) Fats c) Organic acids d) Ethanol

12. Match the regions of the human brain in Column I with their primary functions listed in Column II:

Column I (Brain Region)	Column II (Primary Function)
I. Corpus callosum	a. Regulation of body temperature and urge for eating/drinking
II. Limbic system	b. Connects the left and right cerebral hemispheres
III. Hypothalamus	c. Regulation of sexual behavior and emotional expressions
IV. Cerebellum	d. Provides additional space for neurons and coordinates balance

a) I-b, II-c, III-a, IV-d

c) I-a, II-b, III-c, IV-d

b) I-b, II-a, III-d, IV-c

d) I-d, II-c, III-b, IV-a

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Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

13. Assertion (A): The action spectrum of and the absorption spectrum of chlorophyll a do not show a complete 100% overlap across all wavelengths.

Reason (R): Accessory pigments (like chlorophyll b, xanthophylls, and carotenoids) absorb light at other wavelengths and transfer the energy to chlorophyll a, enabling photosynthesis to occur at those wavelengths.

14. Assertion (A): The leaflet of a compound leaf is not considered a true leaf.

Reason (R): An axillary bud is present in the axil of a petiole of both simple and compound leaves, but not in the axil of leaflets.

15. Assertion (A): The heart rate of an individual can easily be calculated by counting the number of QRS complexes recorded in a given time period.

Reason (R): Each QRS complex corresponds to the repolarization of the atria, marking the end of the cardiac cycle.

16. Assertion (A): Mesosomes help in cell wall formation, DNA replication, and respiration in bacteria.

Reason (R): Mesosomes are extensions of the plasma membrane into the cell in the form of vesicles, tubules, and lamellae.

SECTION B

17. *Funaria* is often referred to as the 'amphibian of the plant kingdom'. Distinguish between its gametophytic and sporophytic phases with respect to their ploidy and nutritional dependence.

18. Leaf A with an area of 15 cm^2 grows to 20 cm^2 in 1 week. Leaf B with an area of 50 cm^2 grows to 55 cm^2 in 1 week. Compare their Absolute Growth Rates (AGR) and Relative Growth Rates (RGR).

19. A drug blocks the release of neurotransmitters from the presynaptic neuron. Although the nerve impulse reaches the axon terminal, the next neuron does not generate an impulse.

a) Why does synaptic transmission fail?

b) Would an electrical synapse be affected in the same way? Give a reason.

Or

A researcher develops a drug that completely blocks the conversion of angiotensin I to angiotensin II.

Based on your knowledge of RAAS, answer the following:

a) How will this affect blood pressure?

b) What will be the effect on aldosterone secretion?

20. State two points of difference between the following:

a) Anaphase of Mitosis and Anaphase I of Meiosis

b) Zygotene and Pachytene

21. Classify the following compounds into its respective group of secondary metabolites:

a) Morphine

b) Concanavalin A

c) Anthocyanin

d) Curcumin

SECTION C

22. Given below are the names of few pathogenic diseases. Name the organisms which cause these diseases and identify the kingdom to which they belong:

a) Malaria

b) Sleeping sickness

c) Rust of wheat

23. Draw a neat and labelled diagram of the digestive system of *Rana tigrine*. (any four labels)

24. a) Compare the microtubular arrangement of a centriole with that of a cilium. Write the standard mathematical notation for both.

b) Identify the primary globular protein that constitutes the proteinaceous filaments of a centriole.

25. During a laboratory investigation, two muscle fibres (A and B) were stimulated under identical conditions.

Muscle Fibre A: Calcium ions were released normally, but ATP was completely depleted after a few contraction cycles.

Muscle Fibre B: ATP was available, but the sarcoplasmic reticulum failed to release calcium ions.

Based on the sliding filament theory, answer the following:

- (a) Which muscle fibre will fail to initiate contraction? Give a reason.
- (b) Which muscle fibre will remain in a contracted state? Explain why.
- (c) State the specific roles of calcium ions and ATP in one complete cycle of muscle contraction.

OR

A severe diabetic patient shows acute ketoacidosis. Blood analysis reveals a significant drop in systemic blood pH (acidosis) along with an elevated body temperature due to an underlying infection. Predict how these metabolic changes affect the oxygen dissociation curve of haemoglobin and explain the physiological advantage of this shift for tissue oxygenation.

26. A woman with blood group O Rh-negative (O⁻) delivers her first child, who has blood group B Rh-positive (B⁺). She subsequently experiences multiple pregnancies that end in foetal loss because the foetuses do not survive. Identify the condition. What is the most probable underlying cause? Explain the mechanism.

27. Give reason:

- a) Tea bushes are regularly pruned at the shoot tips in tea plantations.
- b) Deep water rice plants quickly elongate their petiole or internodes when water levels rise.
- c) Spraying sugarcane crops with GA₃ increases sugar yield per hectare.

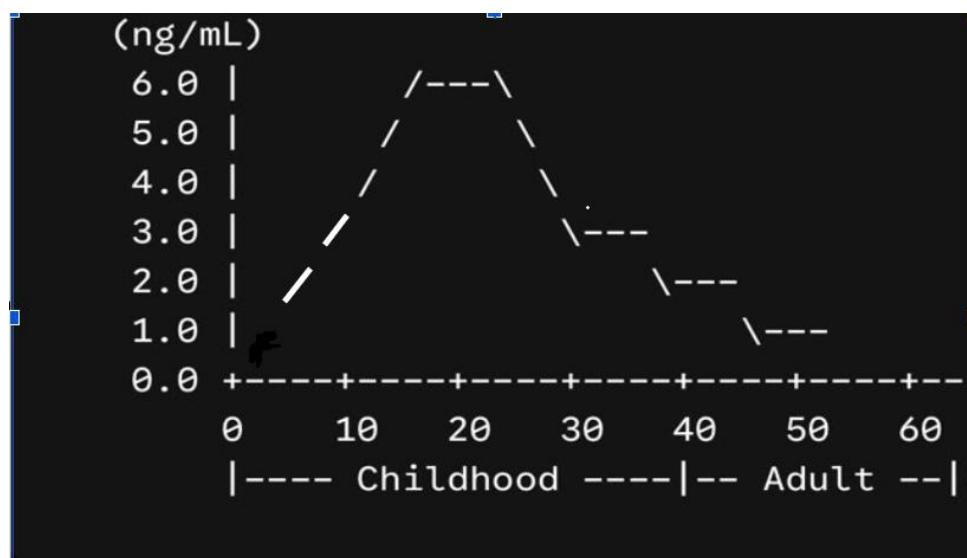
28. Arrange the following taxonomic categories in ascending order (from lower to higher rank):

Diptera, Insecta, Arthropoda, Muscidae

Also, write the scientific name of an organism that belongs to this taxonomic classification.

SECTION D

29. Given below is the graph depicting the level of a particular hormone across various age groups in humans.



a) Identify the hormone and its source gland.

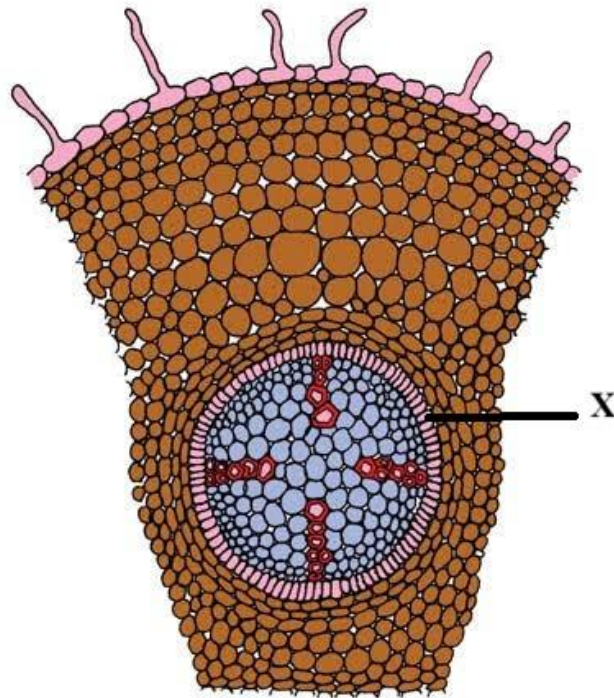
Or

b) Identify the biochemical nature of the hormone and location of its receptor on the target cell.

c) Analyse the pattern of hormonal change with age.

d) Explain the reason for the pattern observed and its impacts on the health of the person.

30. During a practical session, a student observed a section under the microscope as shown in the figure.



a) Identify whether the section depicts a stem or a root. Justify your answer.

b) Give an example of a plant from where the above section can be obtained.

c) Name the layer X and state its main structural feature which helps it perform its function.

Or

d) How are protoxylem and metaxylem placed in relation to each other in this section? What is this condition known as?

SECTION E

31. The anatomical features of five unidentified animal specimen (A-E) are tabulated below. Analyse the features and answer the following questions -

Specimen	Germ Layers	Body Cavity (Coelom)	Body Symmetry	Circulatory System
A	Diploblastic	Non-coelomate	Radial	Absent
B	Triploblastic	Pseudocoelomate	Bilateral	Absent

C	Triploblastic	Acoelomate	Bilateral	Absent
D	Triploblastic	Coelomate	Radial (Adult)	Absent
E	Triploblastic	Coelomate	Bilateral	Open type

- i) Identify the phylum to which specimen A and E belong, respectively.
- ii) Name the structures responsible for excretion or osmoregulation in Specimen B and Specimen C.
- iii) Name the most distinctive feature present in specimen D that is characteristic of its phylum.

OR

- a) A student observes two compatible fungal hyphae under a microscope. Explain the sequence of events that leads to formation of sexual spores.
 - b) Kingdom Protista is often considered as an evolutionary link between Kingdom Monera and Fungi. Give reason.
 - c) 'Diatomaceous earth' has many industrial applications. Justify.
32. a) Compare the process of chemiosmosis in chloroplasts (photophosphorylation) and mitochondria (oxidative phosphorylation) based on:
- i) Primary source of energy used to pump protons.
 - ii) Site of proton accumulation (where the proton gradient builds up).
 - iii) Direction of proton flow through ATP synthase during ATP synthesis.
- b) Predict what will happen to ATP synthesis in a thylakoid suspension if an ionophore (a chemical that makes membranes permeable to protons) is added during photosynthesis. Explain the physiological reasoning behind your answer.

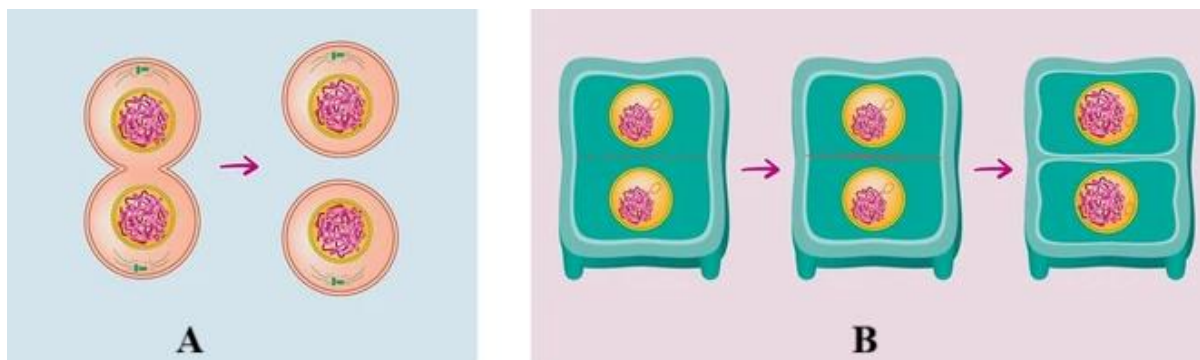
OR

- a) The Calvin cycle requires a specific input of ATP and NADPH for every molecule of CO₂ fixed.
- i) State the exact number of ATP and NADPH molecules used per CO₂ molecule, specifying how many are used in the reduction and regeneration steps.
- ii) Why is the regeneration step crucial for the continuous operation of the Calvin cycle?
- b) Water is a reactant in light reactions, but its effect as a limiting factor on the overall rate of photosynthesis is mostly indirect. Give two indirect ways in which water stress reduces the photosynthetic rate.

33. a) A cell in G1 phase has a DNA content of 2C and a chromosome count of $2n=46$. What will be its DNA content and chromosome number at the following stages of the cell cycle?

- i) Late S phase ii) Metaphase iii) Anaphase

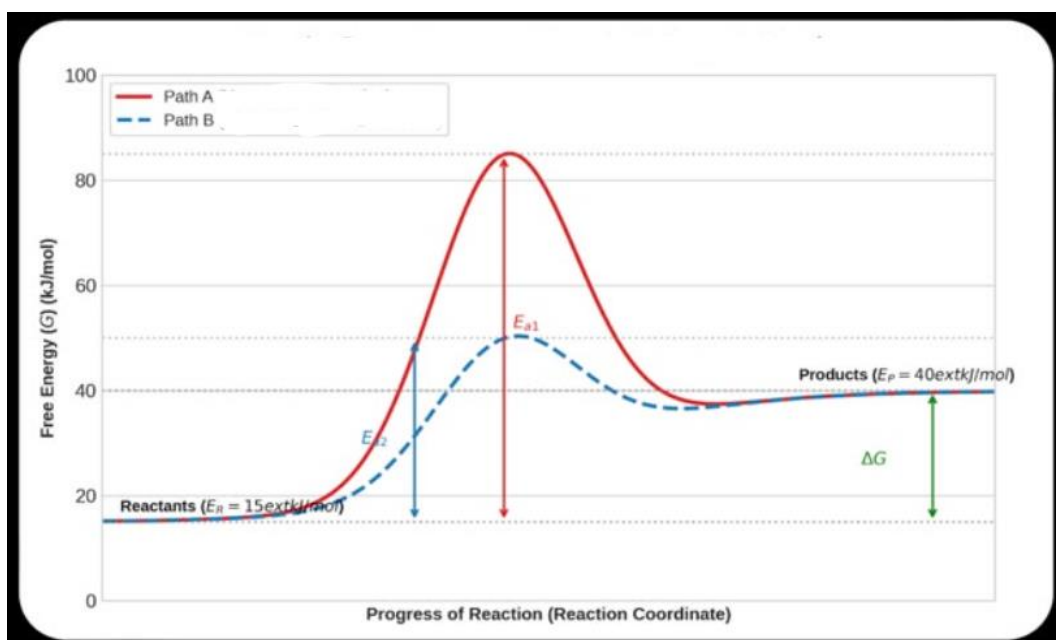
b) Observe the following figures:



Compare and contrast the processes depicted in A and B above.

OR

- a) Observe the graph given below exhibiting the relationship between free energy (G) and progress of reaction:



- i) Identify the type of reaction, whether exothermic or endothermic. Give one reason.
 ii) Explain the reason for the difference observed between E_{A1} and E_{A2} .
 iii) In the given potential energy profile, what do the peak points of Path A and Path B represent in terms of molecular state during a chemical reaction?

b) An enzyme catalyses the conversion of substrate S into product P. A molecule X, which has a structure similar to S, is added to the reaction. The reaction rate decreases. However, when the concentration of S is increased, the reaction rate returns to normal.

Answer the following:

- i) Why does molecule X reduce the reaction rate?
 ii) Mention one practical application of this phenomenon in medicine.