

Ph. D. ENTRANCE TEST (PET) 2025

Signature of Invigilator

Roll.
No.

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Paper - II
Life Sciences

Maximum Marks: 50

No. Of Printed Pages: 8

Instruction for the Candidate:

1. This paper consists of **FIFTY (50)** multiple choice type questions. Each Question carries **ONE (1)** mark.
2. There is no Negative Marking for Wrong Answer.
3. A separate OMR Answer Sheet has been provided to answer questions. Your answers will be evaluated based on your response in the OMR Sheet only. No credit will be given for any answering made in question booklet.
4. Defective question booklet or OMR if noticed may immediately replace by the concerned invigilator.
5. Write roll number, subject code, booklet type, category and other information correctly in the OMR Sheet else your OMR Sheet will not be evaluated by machine.
6. Select most appropriate answer to the question and darken appropriate oval on the OMR answer sheet, with black / blue ball pen only. **DO NOT USE PENCIL** for darkening. In case of over writing on any answer, the same will be treated as invalid. Each question has exactly one correct answer and has four alternative responses (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
Example: (A) ● (B) ● (C) ● (D) ● where (B) is correct response.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. Calculators, Log tables any other calculating devices, mobiles, slide rule, text manuals etc are **NOT** allowed in the examination hall. If any of above is seized from the candidates during examination time; he/ she will be immediately debarred from the examination and corresponding disciplinary action will be initiated by the Center Supervisor as deemed fit.
10. **DO NOT FOLD** or **TEAR** OMR Answer sheet as machine will not be able to recognize torn or folded OMR Answer sheet.
11. **You have to return the OMR Answer Sheet to the invigilator at the end of the examination compulsorily** and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet on conclusion of examination.

Paper - II
Life Sciences

Note: This paper contains **FIFTY (50)** multiple-choice questions. Each Question carries **ONE (1)** mark.

- 01) In a developmental context, "competence" of a responding tissue is defined as its:
A) Ability to migrate in response to morphogens
B) Propensity for lineage-specific differentiation
C) Receptivity to inductive cues from neighboring tissues
D) Capacity for cell cycle re-entry post-commitment
- 02) What happens first when a nerve signal reaches the end of a neuron (synapse)?
A) Sodium rushes in and triggers ATP use
B) Calcium enters, causing neurotransmitter release
C) Neurotransmitters are broken down
D) Potassium exits to open sodium channels
- 03) How does the hormone ADH help the kidneys?
A) It increases salt loss in urine
B) It helps the kidneys reabsorb more water
C) It makes nephrons secrete more glucose
D) It removes calcium from the blood
- 04) What does insulin do after a meal?
A) Increases blood glucose
B) Helps cells take in glucose and store it as glycogen
C) Stops glucose uptake in muscle
D) Breaks down proteins for energy
- 05) In many species, the zygote undergoes an asymmetric transverse division. What developmental feature is primarily established by this division?
A) Establishment of the body axes
B) Orientation of cell division
C) Initiation of cellular polarity
D) Determination of germ layers
- 06) Which of the following results from the specification of organ and stem cell fate in the shoot apical meristem?
A) Phyllotaxy
B) Inflorescence
C) Bract formation
D) Tendril development
- 07) Which of the following hormones has effects opposite to that of insulin on blood glucose levels?
A) Glucagon
B) Somatostatin
C) Calcitonin
D) Aldosterone
- 08) In a dihybrid cross involving independently assorting genes, what is the probability of obtaining progeny with both dominant phenotypes in the F₂ generation?
A) 9/16
B) 3/16
C) 1/16
D) 6/16
- 09) What is the main role of the Spemann organizer during early development in amphibians?
A) Helps form endoderm and suppress mesoderm
B) Controls body axis and helps form nervous system
C) Forms only epidermis
D) Induces extraembryonic tissue only
- 10) What is the primary role of the STM gene in *Arabidopsis* development?
A) Promoting leaf senescence
B) Regulating floral organ identity
C) Maintaining shoot apical meristem
D) Initiating root hair formation
- 11) In summer squash, white fruit color (W) is dominant over yellow (w), and disc-shaped fruit (D) is dominant over sphere-shaped (d). A cross between two white, sphere-shaped plants yields offspring in a phenotypic ratio of 1 white, sphere : 3 yellow, sphere. What are the genotypes of the parents?
A) WWDD × wwdd
B) WwDd × wwdd
C) Wwdd × Wwdd
D) WWDD × WWdd
- 12) Which group of plants completes their life cycle in a very short period before the onset of unfavorable environmental conditions, such as in desert wildflowers and fireweed?
A) Ephemerals
B) Seasonals
C) Annuals
D) Perennials
- 13) Which of the following terms refers to the four main causes of biodiversity loss—habitat loss, overexploitation, alien species invasion, and co-extinctions—that together reduce species diversity in an ecosystem
A) Evil quartet
B) Hellion quartet
C) Foursome
D) Demon

- 14) Which of the following best describes the concept of ecological niche?
- The specific habitat in which an organism lives
 - The feeding level an organism occupies in a food chain
 - The total area over which a species is distributed
 - The functional role of an organism in its ecosystem
- 15) According to the competitive exclusion principle, two species cannot coexist in a stable environment if they:
- Occupy the exact same niche in a stable environment
 - Share similar feeding levels in the food web
 - Live in the same region with overlapping ranges
 - Compete by using entirely different resources
- 16) Which of the following techniques is used to inactivate a specific gene by directly altering its DNA sequence?
- Homologous recombination
 - Introduction of antisense DNA
 - Microinjection of foreign DNA
 - Random mutagenesis
- 17) What is the primary outcome of the RNA interference (RNAi) process in eukaryotic cells?
- Duplication of DNA during replication
 - Degradation of specific messenger RNA
 - Removal of introns from pre-mRNA
 - Folding of polypeptides into functional proteins
- 18) In Lotka-Volterra predator-prey models, an increase in predator population results in:
- Increase in prey population
 - Immediate extinction of prey
 - Stabilization of both populations
 - Decrease in prey population followed by oscillation
- 19) Which of the following ecosystems contributes the highest total Net Primary Production to the world annually?
- Tropical rain forest
 - Ocean
 - Agricultural land
 - Coral reef
- 20) Which of the following is an example of codominance in humans?
- Sickle cell anemia
 - ABO blood group system
 - Cystic fibrosis
 - Albinism
- 21) Which of the following characteristics is unique to the phylum Echinodermata?
- Segmentation
 - Closed circulatory system
 - Water vascular system
 - Exoskeleton
- 22) In the five-kingdom classification proposed by Whittaker, which group is characterized by absorptive heterotrophy and chitinous cell walls?
- Monera
 - Protista
 - Fungi
 - Plantae
- 23) Which of the following scenarios best illustrates the concept of reciprocal altruism in animal behavior?
- Individuals in a colony sacrificing their own reproductive potential for a central figure
 - An animal issuing a warning call that increases its own risk of detection
 - An individual providing aid to another unrelated member, with the benefit returned later
 - A member of a group caring for closely related offspring that are not its own
- 24) The Red Queen Hypothesis in evolution suggests that:
- Species evolve to occupy new niches
 - Evolution proceeds in a linear, progressive fashion
 - Continuous adaptation is necessary to maintain relative fitness
 - Evolutionary stasis is common in most lineages
- 25) Which behaviour is best explained by optimal foraging theory?
- A predator choosing prey that provides the most energy per unit effort
 - A bird performing a complex mating dance
 - A primate grooming another to strengthen social bonds
 - A mother guarding her offspring aggressively
- 26) Why is the high histidine content of hemoglobin considered advantageous?
- Because histidine directly binds oxygen
 - Because histidine transports oxygen to tissues
 - Because histidine has a very low pKa
 - Because histidine provides buffering capacity to hemoglobin

- 27) Which of the following is the most abundant free nucleotide present in living cells?
 A) ATP
 B) GTP
 C) FAD
 D) NAD
- 28) An enzyme shows a hyperbolic Michaelis-Menten plot under normal conditions. Upon addition of an inhibitor that binds outside the active site, the plot becomes sigmoidal. What type of inhibitor is most likely responsible for this change?
 A) An allosteric inhibitor
 B) A competitive inhibitor
 C) A suicide substrate
 D) A covalent modifier
- 29) Which type of chemical interaction is primarily responsible for holding the two strands of a DNA double helix together?
 A) Peptide bonds
 B) Hydrogen bond
 C) Ionic bonds
 D) Covalent bonds
- 30) A DNA sequence changes from TACAGTTGGACT to TACGTTGGACT. What type of mutation does this represent?
 A) Deletion mutation
 B) Silent mutation
 C) Transversion mutation
 D) Reversion mutation
- 31) Which of the following enzymes relieves supercoiling tension during DNA replication in both prokaryotic and eukaryotic cells?
 A) DNA polymerase
 B) DNA ligase
 C) DNA topoisomerase
 D) DNA helicase
- 32) Fluoride specifically inhibits which of the following enzymes in the glycolytic pathway?
 A) Phosphofructokinase
 B) Glucokinase
 C) Enolase
 D) Lactate dehydrogenase
- 33) Which of the following enzymes is located in the inner mitochondrial membrane, not in the mitochondrial matrix?
 A) Citrate synthase
 B) Alpha-ketoglutarate dehydrogenase
 C) Fumarase
 D) Succinate dehydrogenase
- 34) What is the primary function of the Shine-Dalgarno sequence in prokaryotes?
 A) Initiates translation by aligning mRNA with the ribosome
 B) Signals termination of transcription
 C) Facilitates the initiation of DNA replication
 D) Removes introns from precursor mRNA
- 35) Which of the following is a characteristic hallmark of programmed cell death (apoptosis)?
 A) Random degradation of DNA
 B) Cytoplasmic swelling and rupture
 C) Activation of inflammatory response
 D) Fragmentation of DNA into a ladder-like pattern
- 36) Which of the statements about biological membrane is INCORRECT?
 A) Lipids are arranged asymmetrically between the two leaflets
 B) Membranes permit rapid passive diffusion of inorganic ions
 C) Lipid molecules can undergo lateral movement within the membrane
 D) Both integral and peripheral proteins can exhibit lateral mobility.
- 37) Actin filaments participate in all of the following processes except
 A) Ameboid cell movement
 B) Cytoplasmic streaming in plant cells
 C) Contraction of smooth muscle cells
 D) Flagellar propulsion in bacterial cells
- 38) End product of glycolysis is a:
 A) Two carbon compounds
 B) Four carbon compounds
 C) Three carbon compounds
 D) Five carbon compounds
- 39) Which of the following signaling molecules is directly responsible for opening calcium channels on the endoplasmic reticulum?
 A) Inositol 1,4,5-trisphosphate (IP₃)
 B) Diacylglycerol (DAG)
 C) Cyclic guanosine monophosphate (cGMP)
 D) Cyclic adenosine monophosphate (cAMP)
- 40) Insulin binding to its receptor fails to trigger phosphorylation, even though the receptor's kinase domain is structurally intact. Which of the following is the most likely missing component?
 A) ATP
 B) Receptor dimerization
 C) SH2 domain-containing proteins
 D) PIP3 lipid messenger

- 41) Which of the following viral vectors used in gene therapy is particularly effective in infecting neuronal cells?
- Herpes simplex virus
 - Adeno-associated virus
 - Retrovirus
 - Adenovirus
- 42) Which of the following techniques is used to sequence the entire genome of an organism?
- Polymerase chain reaction
 - DNA microarray analysis
 - Sanger sequencing
 - Next-generation sequencing
- 43) In SDS-PAGE, proteins are primarily separated based on which of the following properties?
- Molecular size
 - Native three-dimensional structure
 - Net electrical charge
 - Charge-to-mass ratio
- 44) Which of the following reagents is commonly used to visualize DNA bands in an agarose gel?
- Ethidium bromide
 - Green fluorescent protein
 - Sodium dodecyl sulfate
 - Bromophenol blue
- 45) What is the primary molecular cause of diarrhea during cholera infection?
- Persistent activation of Gs protein
 - Irreversible stimulation of adenylate cyclase
 - Accelerated recycling of G protein subunits
 - Enhanced hydrolysis of GTP to GDP by G proteins
- 46) What is the function of the heat shock protein Hsp70 in bacteria?
- Initiation of DNA replication
 - Assistance in proper protein folding
 - Regulation of bacterial cell division
 - Development of antibiotic resistance
- 47) Which of the following techniques is commonly used for site-directed mutagenesis in protein engineering?
- Western blotting
 - Gel electrophoresis
 - Southern blotting
 - Polymerase chain reaction
- 48) Flow cytometry analysis detects a population of cells expressing CD3⁺CD4⁺CD8⁻ surface markers. Which of the following best identifies these cells?
- Cytotoxic T cells
 - Helper T cells
 - B lymphocytes
 - Natural killer (NK) cells
- 49) The statements given below describe an angiosperm flower.
- A flower develops in the axils of bracts like axillary shoots.
 - The floral pedicel is the elongated node and the axis is condensed, like in a shoot.
 - Floral parts like calyx, corolla, androecium and gynoecium are modified leaves.
 - Floral buds may sometimes get modified into vegetative buds or bulbils.
- Select the option with all correct statements that support the idea that a flower is a modified shoot.
- a, b and c
 - a, b and d
 - b, c and d
 - a, c and d
- 50) Which of the following crops is known to be a highly efficient converter of solar energy, with a net primary productivity of 204 kg/m² or more?
- wheat
 - sugarcane
 - rice
 - bajra
- *****

Rough Work: