

National Level ScienceX Olympiads

ScienceX Biology Olympiad (SBO)

Name: _____

Date: _____

Exam Instructions

1. The timer has been set for the exam, and a countdown will display the remaining time. When the timer runs out, the exam will end automatically. No further action will be required after that.
2. You can flag any question that you want.
3. If you don't want to submit any of your provided answers, you can clear them.
4. If you choose to drop this exam, it will not be submitted, and no result will be generated.
5. Once you finish the exam, you cannot resume it.

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- Open a new program
- Taking a screenshot
- Pressing Ctrl + C
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- Pressing Print Screen
- Pressing F12

We are monitoring your activity during the exam, and any unusual behaviour is being tracked. Your admin has set the exam to terminate if a certain number of unusual activities are detected, which could be as low as one. To avoid your exam from being terminated, please refrain from any behaviour that may be considered unusual. All the best!

Question: 1 of 50

QID: 172

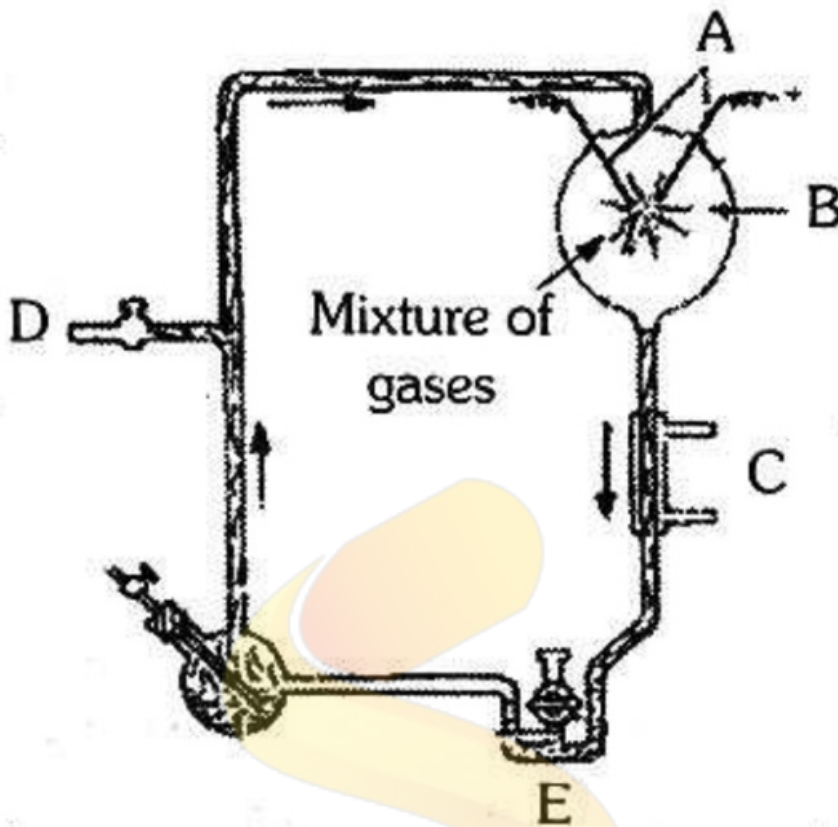
Marks: 4

To cope with limited water availability, desert plants exhibit which of the following morphological and physiological adaptations?

Please mark (✓) for the correct answer.

- A.** Epidermal modifications like sunken stomata. **B.** Reduced leaf surface area or transformed leaves.
- C.** Extensive root systems for efficient water and nutrient acquisition. **D.** All of the aforementioned adaptations.

The diagram represents Miller's experiment. Choose the correct combination of labelling



Please mark (✓) for the correct answer.

- A. A-electrodes, B- $\text{NH}_4 + \text{H}_2 + \text{CO}_2 + \text{CH}_3$, C-hot water, D-vacuum, E-U trap
- B. A-electrodes, B- $\text{NH}_3 + \text{H}_2 + \text{H}_2\text{O} + \text{CH}_4$, C-steam, D- vacuum, E-U trap
- C. A-electrodes, B- $\text{NH}_3 + \text{H}_2 + \text{H}_2\text{O} + \text{CH}_4$, C-cold water, D-vacuum, E-U trap
- D. A-electrodes, B- $\text{NH}_3 + \text{H}_2\text{O}$, C-hot water, D-tap, E-U trap

The result of one whole Krebs cycle is:

Please mark (✓) for the correct answer.

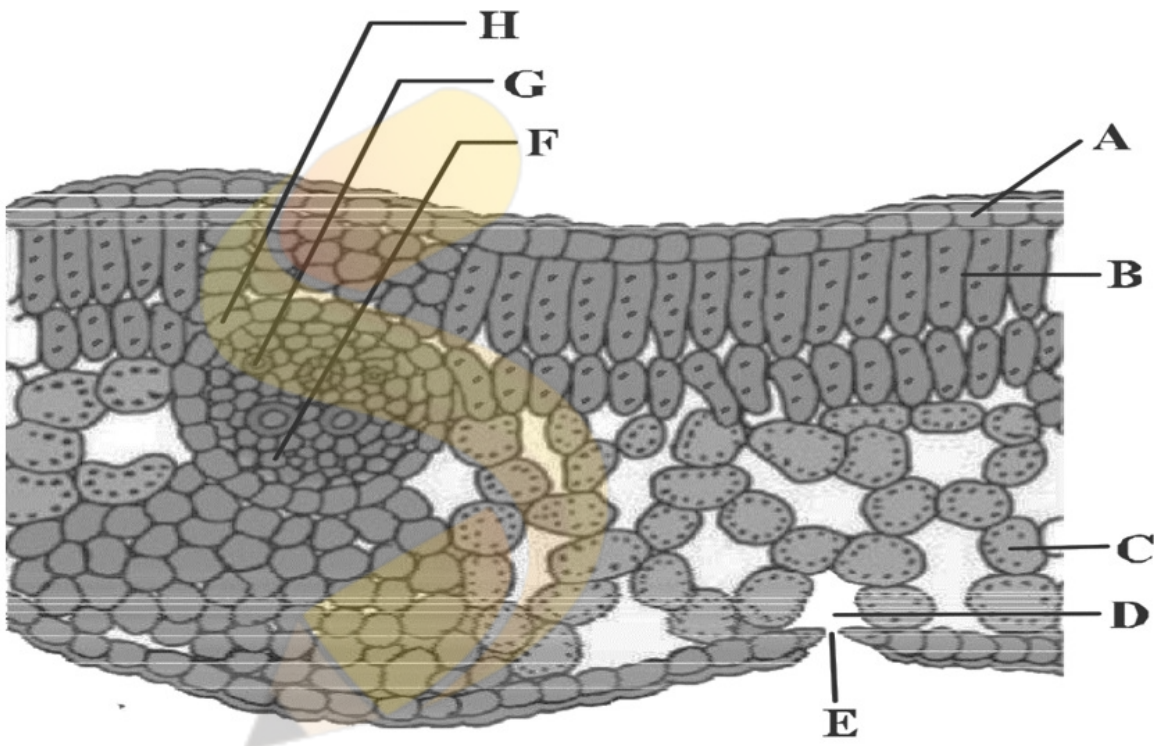
- A. 1 FADH_2 molecule, 3 NADH molecules, and 2 ATP molecules.
- B. 0 FADH_2 molecules, 4 NADH molecules, and 4 ATP molecules.
- C. 3 FADH_2 molecules, 1 NADH molecule, and 1 ATP molecule.
- D. 2 FADH_2 molecules, 2 NADH molecules, and 3 ATP molecules.

Paramecium's contractile vacuoles resemble:

Please mark (✓) for the correct answer.

- A. Lymph system in humans: B. Uriniferous tubules
- C. Sweat glands of mammals D. Gastrointestinal tract of Hydra

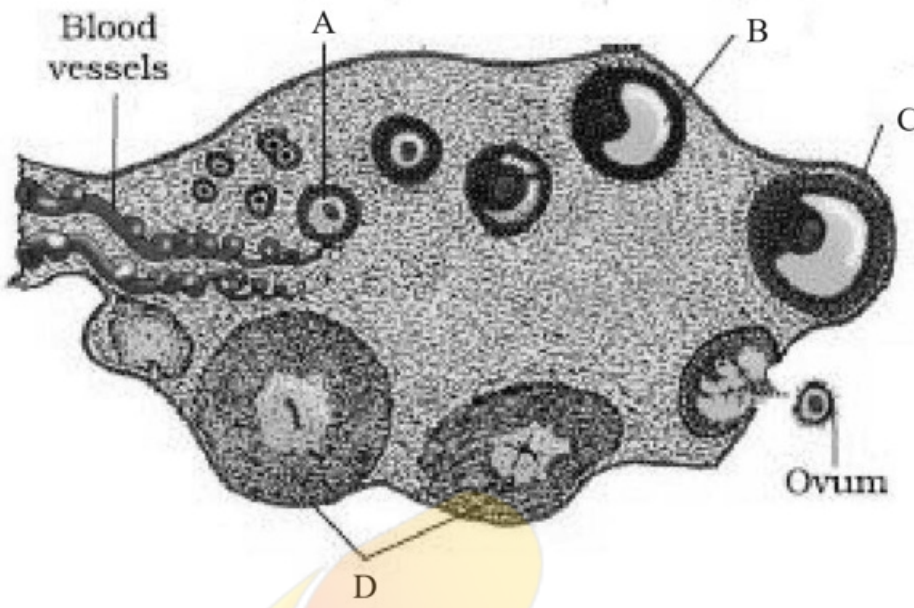
T.S. of dicot leaf is given. Identify the correct option



Please mark (✓) for the correct answer.

- A. A – Epidermis, B – Palisade parenchyma, C – Spongy parenchyma, D – Sub-stomatal cavity, E – Stoma, F – Phloem, G – Metaxylem, H – Bundle sheath
- B. A – Epidermis, C – Palisade parenchyma, C – Spongy parenchyma, D – Stomata, E – Guard cells, F – Phloem, G – Metaxylem, H – Protoxylem
- C. A – Epidermis, B – Spongy parenchyma, C – Palisade parenchyma, D – Stomata, E – Guard cells, F – Phloem, G – Metaxylem, H – Protoxylem
- D. A – Epidermis, B – Palisade parenchyma, C – Spongy parenchyma, D – Stomata, E – Guard cells, F – Epidermis, G – Xylem, H – Phloem

The figure given below shows the sectional view of ovary. Select the option of marked structure (A to D) and its feature.



Please mark (✓) for the correct answer.

- A. A: Primary follicle, it is also called gamete mother cell.
- B. B: Corpus luteum, it cannot be formed and added after birth.
- C. C: Graafian follicle, mature follicle which ruptures to release secondary oocyte.
- D. D: Tertiary follicle, a large number of this follicle degenerates during the phase from birth to puberty.

Match the statements from Column A with Column B regarding the step of kerbs' cycle involving conversion of pyruvic acid to acetyl CoA

Column A	Column B
A. Pyruvic acid	i. Reduced
B. NAD ⁺	ii. 3 Carbon atoms
C. Acetyl CoA	iii. Oxidised

Please mark (✓) for the correct answer.

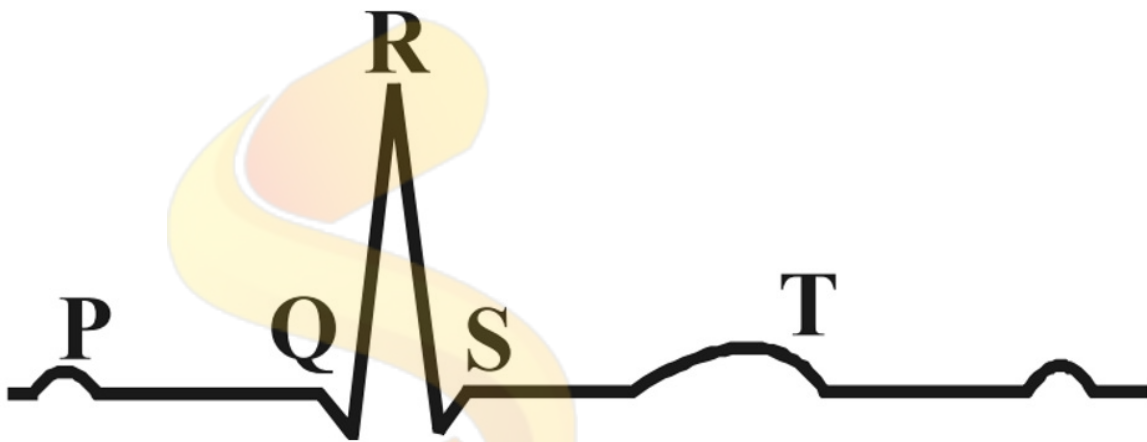
- A. A → ii, B → iii, C → i
- B. A → ii, B → i, C → iii
- C. A → iii, B → i, C → ii
- D. A → i, B → ii, C → iii

TATA box of eukaryotic promotor lies

Please mark (✓) for the correct answer.

- A. about 25 bp upstream of the transcription start site.
- B. about 75 bp upstream of the transcription start site.
- C. about 200 bp upstream of the transcription start site.
- D. about 50 bp upstream of the transcription start site.

The diagram given here is the standard ECG of a normal person, identify the **incorrect** statement.



Please mark (✓) for the correct answer.

- A. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction.
- B. The contraction starts shortly after P and marks the repolarisation of atria.
- C. The contraction starts shortly after Q and marks the beginning of the systole.
- D. The P-wave represents the electrical excitation of the atria, which leads to the contraction of both the atria.

Out of the following statements about enzymes, which statement (s) are **incorrect**?

- (i) Enzymes having slightly different molecular structure but performing identical activities are holoenzymes.
- (ii) An allosteric enzyme has an additional binding site for effector molecules other than the active site.
- (iii) The Turn over number is the maximal number of molecules of substrate converted to product per active site per unit time.
- (iv) Enzymes are sensitive to light, pH, wind and temperature.

Please mark (✓) for the correct answer.

- A. (i) and (ii)
- B. (i), (iii) and (iv)
- C. (i) and (iii)
- D. (i) and (iv)

Which of the following compounds is "**MOST LIKELY**" a key player in both nitrogen metabolism and "**kreb's cycle**"?

Please mark (✓) for the correct answer.

- A. Urea
- B. Fumaric acid
- C. α -Ketoglutarate
- D. Oxaloacetate

Identify the Ribonucleoside

Please mark (✓) for the correct answer.

- A. Uridine= Uracil + ribose + Phosphate
- B. Uridine= Uracil + ribose
- C. Uridylic acid = Uracil + ribose
- D. Uridylic acid = Uracil + ribose + Phosphate

Out of the following statements, which statement (s) are **correct**?

- (i) No cell is without ribosomes.
- (ii) Prokaryotic genetic system has both DNA and histones.
- (iii) tRNA is the soluble RNA.
- (iv) DNA differs from RNA in term of sugar only.

Please mark (✓) for the correct answer.

- A. (ii) and (iv)
- B. (i) and (iii)
- C. (i) and (ii)
- D. (i), (ii) and (iii)

The connecting link between glycolysis, kreb's cycle and β -oxidation of fatty acid is

Please mark (✓) for the correct answer.

- A. Acetyl CoA
- B. Oxaloacetate
- C. Pyruvic acid
- D. α -Ketoglutarate

According to Hardy-Weinberg principle, allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences. It makes several assumptions which were given below.

- (i) Random Mating
- (ii) Sexual Reproduction
- (iii) Non-overlapping Generations
- (iv) Occurrence of Natural Selection
- (v) Small size of population.

Identify two assumptions which do not meet for a population to reach Hardy-Weinberg Equilibrium?

Please mark (✓) for the correct answer.

- A. (i), (ii) and (iii) B. (ii) and (iv)
- C. (iv) and (v) D. (iii), (iv) and (v)

Oxyhaemoglobin at the tissue level releases oxygen to the cells during oxygen transport because in tissue

Please mark (✓) for the correct answer.

- A. PO_2 is low and PCO_2 is high. B. PO_2 is high and PCO_2 is high.
- C. PO_2 is high and PCO_2 is low. D. PO_2 is low and PCO_2 is low.

Which statement **BEST** describes the relationship between potato and sweet potato?

Please mark (✓) for the correct answer.

- A. They belong to the same genus. B. The same part is edible in both.
- C. Their edible parts are homologous organs. D. Their edible parts are analogous organs.

Chasmogamy refers to the condition where

Please mark (✓) for the correct answer.

- A. Flowers are absent. B. Flower are gamopetalous.
- C. Flowers remains closed. D. Flowers are open.

Out of the following statements, identify the **correct** statement (s)?

- (i) Chloragogen cells of earthworm are similar to liver of vertebrates.
- (ii) Water current in Leucosolenia is produced by choanocytes.
- (iii) Presence of haemocoel is a characteristic of arthropods and molluscs.
- (iv) Chondrichthyes have placoid scales.

Please mark (✓) for the correct answer.

- A.** (i), (ii)
 B. (i), (ii), (iii) and (iv)
- C.** (i), (ii) and (iii)
 D. None of the above.

Leydig cells are found in

Please mark (✓) for the correct answer.

- A.** Kidney of human
 B. Testes of rabbit
- C.** Testes of frog
 D. Kidney of frog

Which one of the following is a matching pair?

- (i) **Lubb** - Sharp closure of AV valves at the beginning of ventricular systole.
- (ii) **Dup** - Sudden opening of AV valves at the beginning of ventricular diastole.
- (iii) **AV node** - Pace maker of the heart.
- (iv) **Purkinje fibres** - Initiation of the heart beat

Please mark (✓) for the correct answer.

- A.** (iii), (iv)
 B. (i)
- C.** (i), (ii)
 D. (ii), (iii)

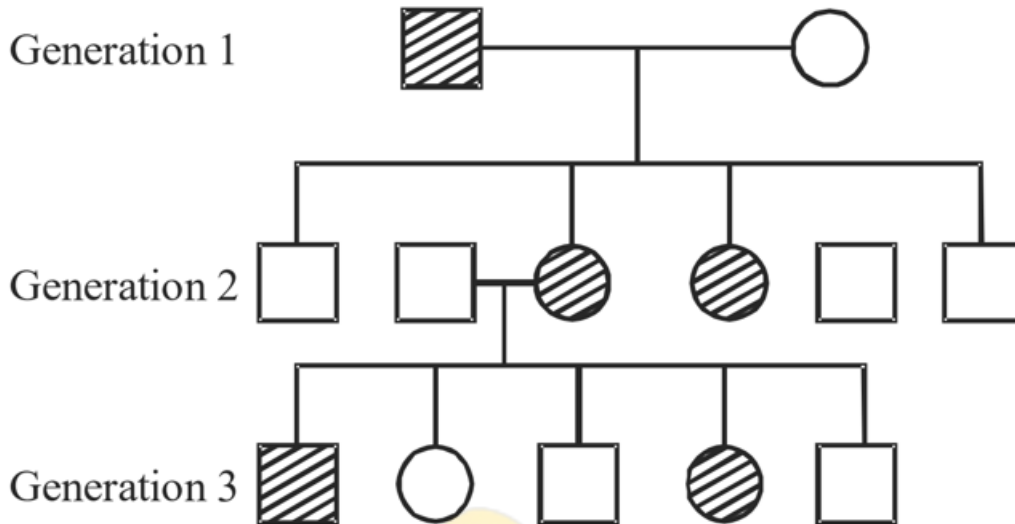
Select the correct matching of the type of the joint with the example in human skeletal system:

Type of joint	Example
a) Pivot joint	between third and fourth cervical vertebrae
b) Cartilaginous joint	between frontal and parietal
c) Gliding joint	between carpals
d) Hinge joint	between humerus and pectoral girdle

Please mark (✓) for the correct answer.

- A.** b)
 B. a)
- C.** d)
 D. c)

Given below is a pedigree chart showing the inheritance of a certain trait in humans.



Please mark (✓) for the correct answer.

- A. recessive X-linked
- B. recessive Y-linked
- C. dominant X-linked
- D. dominant Y-linked

Question: 24 of 50

QID: 176

Marks: 4

Regarding cell connections, which of the following statements is **untrue**?

- (i) Tiny intercellular materials hold the epithelium's cells collectively.
- (ii) Specialized junctions serve as a structural and functional link between individual cells in nearly all animal tissues.
- (iii) Materials leaking across a tissue can be prevented in part by Gap junctions.
- (iv) Adhering junctions act as a glue to hold adjacent cells together.
- (v) Cytoplasmic channels for the transit of ions, small molecules, and occasionally large molecules are provided by gap junctions between cells.

Please mark (✓) for the correct answer.

- A. (ii)
- B. (iii)
- C. All are correct.
- D. (i)

Question: 25 of 50

QID: 193

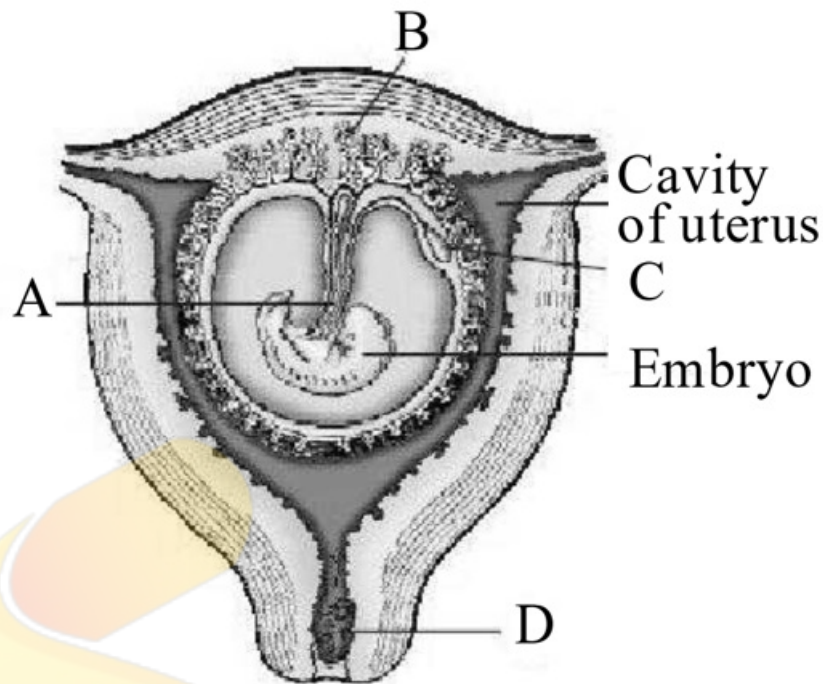
Marks: 4

Geitonogamy involves:

Please mark (✓) for the correct answer.

- A. fertilization of a flower by the pollen from a flower of another plant in the same population.
- B. fertilization of a flower by the pollen from the same flower.
- C. fertilization of a flower by the pollen from a flower of another plant belonging to a distant population.
- D. fertilization of a flower by the pollen from another flower of the same plant.

The given figure shows the human foetus within the uterus with few structures.



Identify the A, B, C and D.

Please mark (✓) for the correct answer.

- A. A → Umbilical cord with its veins, B → Placental villi, C → Trophoblast, D → Plug of mucus in vagina
- B. A → Umbilical cord with its vessels, B → Placental villi, C → Yolk sac, D → Plug of mucus in cervix
- C. A → Umbilical cord with its veins, B → Chorionic villi, C → Antrum, D → Plug of mucus in cervix
- D. A → Umbilical cord with its vessels, B → Fimbriae, C → Oocyte, D → Plug of mucus in vagina

Consider a molecule consisting of three fatty acid spokes that radiate outward from a central "hub" that resembles glycerol. It relates to

Please mark (✓) for the correct answer.

- A. Nucleic acid, a key molecule that carries genetic information.
- B. Sterol is involved in the construction of cell membranes, just like cholesterol.
- C. Protein, which is in charge of creating and preserving tissues.
- D. Monosaccharide, which is the building block of all carbohydrates.

Study the following statements

(i) Hormone "X": Stimulates milk production in mothers after childbirth.

(ii) Hormone "Y": Promotes the development of secondary sexual characteristics in males.

(iii) Hormone "Z": Plays a crucial role in the circadian rhythm and sleep-wake cycles.

Identify the correct names of hormones marked as 'X', 'Y' & 'Z'.

Please mark (✓) for the correct answer.

- A. X: Somatotropin, Y: Testosterone, Z: Luteinizing hormone.
- B. X: Oxytocin, Y: Corticosteroids, Z: Epinephrine.
- C. X: Somatotropin, Y: Testosterone, Z: Epinephrine.
- D. X: Oxytocin, Y: Testosterone, Z: Melatonin.

Which of the following has the lowest urea content?

Please mark (✓) for the correct answer.

- A. Hepatic portal vein
- B. Pulmonary vein
- C. Vena cava
- D. Renal vein

Assertion: Prothrombinase enzyme act as antiheparin.

Reason: Heparin prevent coagulation of blood in blood vessels.

Please mark (✓) for the correct answer.

- A. If the Assertion is correct but Reason is incorrect.
- B. If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- C. If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- D. If both the Assertion and Reason are incorrect.

Which hormones are antagonistic?

Please mark (✓) for the correct answer.

- A. Insulin and glucagon
- B. Growth hormone and epinephrine
- C. Thyroxine and thymosin
- D. ACTH and glucocorticoids

Out of the following statements, identify the **incorrect** statement (s)?

- (i) NADP^+ is a hydrogen acceptor.
- (ii) Nitrogen is the constituent of natural silk.
- (iii) Nucleotide found free in the cell is ATP.
- (iv) Manganese is structural component of Chlorophyll molecule.

Please mark (✓) for the correct answer.

- A. (ii) and (iii)
 B. None of the above.
- C. (i)
 D. (iv)

The vagus nerve is the _____ cranial nerve

Please mark (✓) for the correct answer.

- A. 10th
 B. 8th
- C. 9th
 D. 3rd

Which of the following four glands best fits the description that relates with it?

a) Parathyroid	Secretes para-thormone, which promotes movement of calcium ions from blood into bones during calcification
b) Thymus	Starts undergoing atrophy after puberty
c) Pancreas	Delta cells of the 'islets of Langerhans' secrete a hormone, which stimulates glycolysis in liver
d) Thyroid	Hyperactivity in young children causes cretinism

Please mark (✓) for the correct answer.

- A. d)
 B. c)
- C. a)
 D. b)

To find out if an organism is homozygous or heterozygous for a trait under investigation, mating it to a double recessive is known as

Please mark (✓) for the correct answer.

- A. back cross
 B. dihybrid cross
- C. reciprocal cross
 D. test cross

In Hammerling's classic experiment on the single-celled alga *Acetabularia*, nuclei from different parts of the plant were transplanted to regenerate entire individuals. Based on the results, which of the following statements **BEST** demonstrates critical thinking about the nature of cellular differentiation?

- (i) The nucleus alone contains all the information necessary for complete development.
- (ii) Cytoplasmic signals play a crucial role in directing specific development programs.
- (iii) Both nucleus and cytoplasm contribute to the final form and function of an organism.

Please mark (✓) for the correct answer.

- A. (i) and (iii)
- B. (i), (ii) and (iii)
- C. (i) and (ii)
- D. (ii) and (iii)

The concentration of substrate at which an enzyme reaches half of its maximal speed is

Please mark (✓) for the correct answer.

- A. Reaction rate constant
- B. Threshold concentration
- C. Turnover number
- D. Michaelis constant

GIFT stands for

Please mark (✓) for the correct answer.

- A. the injection-assisted transport of a sperm into a female's fallopian tube.
- B. An embryo is created in a lab and subsequently placed into a woman's body.
- C. the implantation of an ovum taken from a donor into the fallopian tube of a different female who is unable to conceive but can offer an ideal environment for development.
- D. implantation of an in vitro fertilized zygote into a female infertile person's fallopian tube.

Which of the following would be predicted if Henle's loop is absent from a mammalian nephron?

Please mark (✓) for the correct answer.

- A. The urine would be more concentrated
- B. The urine would be more diluted.
- C. There would be very little variation in the amount and quality of urine created
- D. No urine would form

A recent red tide outbreak has plagued the coastline, causing fish deaths. Which of the following is **MOST** likely responsible for the red tide in this scenario?

Please mark (✓) for the correct answer.

- A. Dinoflagellate *Gonyaulax* species.
- B. It's impossible to determine without further analysis of the specific algal bloom.
- C. Red coloured planktonic algae *Trichodesmium erythreum*.
- D. Red coloured algae *Chlamydomonas nivalis*.

Natural system of classification is based on

Please mark (✓) for the correct answer.

- A. Morphology and ontogeny
- B. Morphology only
- C. Morphology and Phylogeny
- D. Phylogeny only

Match the Taxa from **Column A** with ending given in **Column B**

Column A	Column B
A. Division	i. -aceae
B. Family	ii. -ales
C. Order	iii. -phyceae
D. Class	iv. -phyta

Please mark (✓) for the correct answer.

- A. A→ i, B→ ii, C→ iv, D→ iii
- B. A→ iv, B→ i, C→ ii, D→ iii
- C. A→ i, B→ ii, C→ iii, D→ iv
- D. A→ iv, B→ i, C→ iii, D→ ii

Assertion: The imbalance in concentration of Na^+ , K^+ and proteins generates resting potential.

Reason: To maintain the unequal distribution of Na^+ & K^+ , the neurons use electrical energy.

Please mark (✓) for the correct answer.

- A. If both the Assertion and Reason are incorrect.
- B. If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
- C. If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
- D. If the Assertion is correct but Reason is incorrect.

Double fertilization involves

Please mark (✓) for the correct answer.

- A. two sperm carried by the same pollen tube fertilizing the egg and the polar nuclei.
- B. the fertilization of two eggs by two sperm carried by a single pollen tube inside the same embryo sac.
- C. two male gametes fertilize an egg
- D. the fertilization of the polar nuclei and egg by two sperm transported by distinct pollen tubes.

Assertion: Gram-negative bacteria lack the ability to preserve the stain after exposure to alcohol.

Reason: This inability stems from the composition of their outer membrane, specifically the presence of alcohol-soluble lipopolysaccharides.

Please mark (✓) for the correct answer.

- A. If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- B. If both the Assertion and Reason are incorrect.
- C. If Assertion is correct but Reason is incorrect.
- D. If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

Imagine you're a scientist studying how viruses can shuffle genes between organisms. Which of the following terms accurately describes this transfer of genetic material with the help of a virus?

Please mark (✓) for the correct answer.

- A. Transference
- B. Transduction
- C. Transformation
- D. Translation

There are three genes **a**, **b**, **c**. Percentage of crossing over between **a** and **b** is 20%, **b** and **c** is 28% and **a** and **c** is 8%. What is the sequence of genes on chromosome?

Please mark (✓) for the correct answer.

- A. **a, b, c**
- B. None of these
- C. **a, c, b**
- D. **b, a, c**

Which of the following cell types, found in plants and animals, typically lack a nucleus?

Please mark (✓) for the correct answer.

- A. Erythrocytes, Parenchyma cells, Sperm cells
- B. Erythrocytes, Xylem vessels
- C. Sperm cells, Xylem vessels, Muscle cells
- D. Xylem vessels, Muscle cells

Match the statements from **Column A** with the stages of Meiosis I given in **Column B**

Column A	Column B
A. Synapsis	i. Pachytene
B. Crossing over	ii. Zygotene
C. Chiasmata	iii. Diakinesis
D. Terminalisation	iv. Diplotene

Please mark (✓) for the correct answer.

- A. A → ii, B → i, C → iv, D → iii
- B. A → ii, B → i, C → iii, D → iv
- C. A → i, B → ii, C → iii, D → iv
- D. A → i, B → ii, C → iv, D → iii

Match the Taxa from Column A with Column B

Column A	Column B
A. Mushrooms	i. Fungi imperfecti
B. <i>Puccinia</i>	ii. Symbiont
C. Deuteromycetes	iii. Rust fungus
D. Lichen	iv. Basidiomycetes

Please mark (✓) for the correct answer.

- A. A → i, B → ii, C → iv, D → iii
- B. A → iv, B → iii, C → i, D → ii
- C. A → i, B → iii, C → iv, D → ii
- D. A → iv, B → i, C → iii, D → ii

--- END OF QUESTION PAPER ---

Answer Key

No	Question Type	QID	Correct Answer
Question - 1	Multiple Choice (Radiobutton)	172	D
Question - 2	Multiple Choice (Radiobutton)	195	C
Question - 3	Multiple Choice (Radiobutton)	161	A
Question - 4	Multiple Choice (Radiobutton)	170	B
Question - 5	Multiple Choice (Radiobutton)	175	A
Question - 6	Multiple Choice (Radiobutton)	196	C
Question - 7	Multiple Choice (Radiobutton)	162	C
Question - 8	Multiple Choice (Radiobutton)	198	A
Question - 9	Multiple Choice (Radiobutton)	182	B
Question - 10	Multiple Choice (Radiobutton)	159	D
Question - 11	Multiple Choice (Radiobutton)	163	C
Question - 12	Multiple Choice (Radiobutton)	156	B
Question - 13	Multiple Choice (Radiobutton)	155	B
Question - 14	Multiple Choice (Radiobutton)	164	A
Question - 15	Multiple Choice (Radiobutton)	188	C
Question - 16	Multiple Choice (Radiobutton)	181	A
Question - 17	Multiple Choice (Radiobutton)	174	D
Question - 18	Multiple Choice (Radiobutton)	191	D
Question - 19	Multiple Choice (Radiobutton)	171	B
Question - 20	Multiple Choice (Radiobutton)	189	C
Question - 21	Multiple Choice (Radiobutton)	180	B
Question - 22	Multiple Choice (Radiobutton)	202	D
Question - 23	Multiple Choice (Radiobutton)	190	A
Question - 24	Multiple Choice (Radiobutton)	176	B
Question - 25	Multiple Choice (Radiobutton)	193	C
Question - 26	Multiple Choice (Radiobutton)	199	B
Question - 27	Multiple Choice (Radiobutton)	160	B
Question - 28	Multiple Choice (Radiobutton)	178	D
Question - 29	Multiple Choice (Radiobutton)	177	D
Question - 30	Multiple Choice (Radiobutton)	179	C
Question - 31	Multiple Choice (Radiobutton)	186	A
Question - 32	Multiple Choice (Radiobutton)	158	B
Question - 33	Multiple Choice (Radiobutton)	184	A
Question - 34	Multiple Choice (Radiobutton)	203	D
Question - 35	Multiple Choice (Radiobutton)	187	D
Question - 36	Multiple Choice (Radiobutton)	166	B
Question - 37	Multiple Choice (Radiobutton)	157	D
Question - 38	Multiple Choice (Radiobutton)	194	C
Question - 39	Multiple Choice (Radiobutton)	183	B
Question - 40	Multiple Choice (Radiobutton)	169	A
Question - 41	Multiple Choice (Radiobutton)	167	C
Question - 42	Multiple Choice (Radiobutton)	201	B
Question - 43	Multiple Choice (Radiobutton)	185	D

No	Question Type	QID	Correct Answer
Question - 44	Multiple Choice (Radiobutton)	192	A
Question - 45	Multiple Choice (Radiobutton)	173	A
Question - 46	Multiple Choice (Radiobutton)	168	B
Question - 47	Multiple Choice (Radiobutton)	197	D
Question - 48	Multiple Choice (Radiobutton)	165	B
Question - 49	Multiple Choice (Radiobutton)	200	A
Question - 50	Multiple Choice (Radiobutton)	204	B

--- END OF ANSWER KEY ---

