AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XII

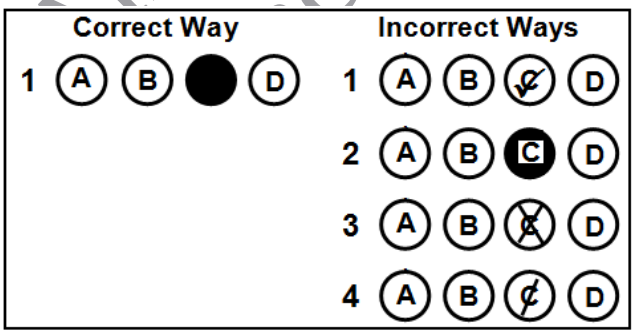
ANNUAL EXAMINATIONS (THEORY) 2023

Biology Paper I

Time: 1 hour 30 minutes Marks: 50

INSTRUCTIONS

1. Read each question carefully.
2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.
3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 50 only.
4. In each question, there are four choices A, B, C, D. Choose ONE. On the answer grid, black out the circle for your choice with a pencil as shown below.



Candidate's Signature

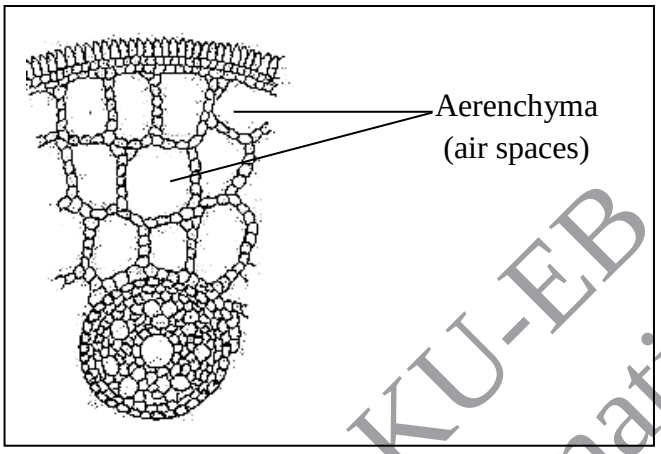
5. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.
6. DO NOT write anything in the answer grid. The computer only records what is in the circles.
7. You may use a scientific calculator

1. Antidiuretic hormone (ADH) affects the functioning of human nephron.

   If ADH is secreted in low quantity, then it affects the

   A. reabsorption of water in collecting duct.
   B. removal of hydrogen ions from peritubular capillaries.
   C. removal of water from ascending limb of loop of Henle.
   D. reabsorption of sodium ions in the proximal convoluted tubule.

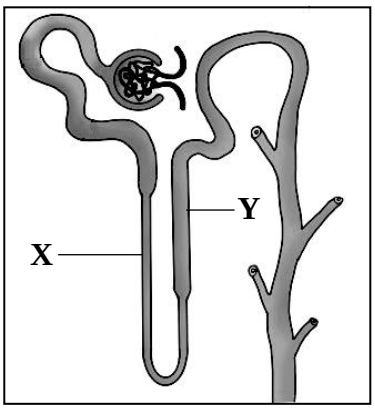
2. The given diagram shows the transverse section of a stem.



   With reference to osmoregulation, the plant that has the shown anatomical feature is

   A. sunflower plant.
   B. water lily.
   C. cactus.
   D. pinus.

3. The given diagram represents a healthy human nephron.



   In contrast to filtrate at point **X**, the filtrate at point **Y** has

   A. lesser salt concentration.
   B. greater red blood cell count.
   C. lesser number of plasma protein.
   D. greater number of glucose molecules.

4. One of the ways through which freshwater fish compensate the loss of salts from their bodies is that they

   A. drink large amount of water.
   B. produce small volumes of concentrated urine.
   C. uptake salts by gills and skin via active transport.
   D. retain adequate concentrations of urea in their bodies.

5. In people with a kidney disease, the over-use of painkillers causes blood cells to leak in urine.

   This is because the pain killers MAINLY

   A. cause the hypersecretion of anti-diuretic hormone.
   B. reduce the efficiency of glomerulus to filter the blood.
   C. increase the reabsorption of water through descending loop of Henle.
   D. decrease the reabsorption of sodium through ascending loop of Henle.

6. The point of origin and insertion of brachialis muscles of arm in human skeletal system is

	Origin	**Insertion**
A	scapula	radius
B	humerus	radius
C	scapula	ulna
D	humerus	ulna

7. Ankle joint is formed by the articulation of

   A. distal ends of tibia-fibula and tarsal bones.
   B. distal ends of tibia-fibula and carpal bones.
   C. proximal end of tibia-fibula and tarsal bones.
   D. proximal end of tibia-fibula and carpal bones.

8. The MRI report of a person unveils the degeneration of intervertebral discs in the lumbar region and protrusion of the spongy nucleus pulposus.

   The report indicates that the person is suffering from

   A. sciatica.
   B. spondylosis.
   C. slipped disc.
   D. disc tumour.

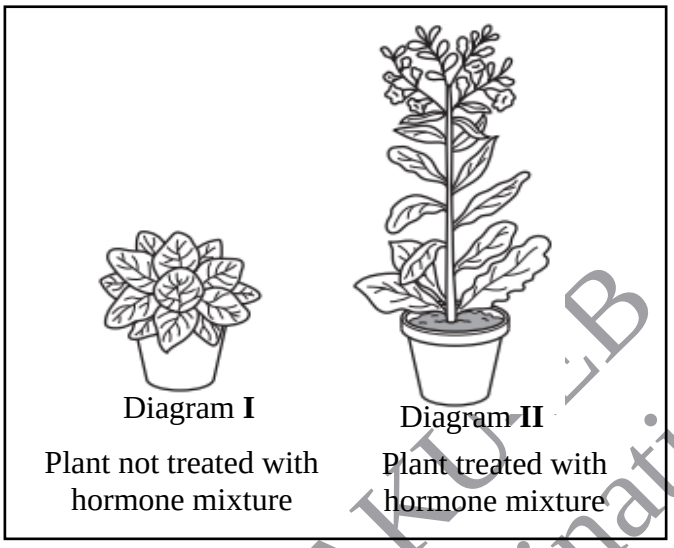
9. Which of the following options CORRECTLY describes the features of muscles found in the walls of stomach and intestine of humans?

   A. Irregularly striped and spindle shaped with one nucleus per cell
   B. Unstriped and spindle shaped with one nucleus per cell
   C. Unstriped, branched and voluntary in action
   D. Striped, cylindrical and voluntary in action

10. In dicot plants, vascular cambium is a cylinder of actively dividing cells between

A. primary xylem and primary phloem.
B. primary xylem and secondary xylem.
C. primary xylem and secondary phloem.
D. primary phloem and secondary phloem.

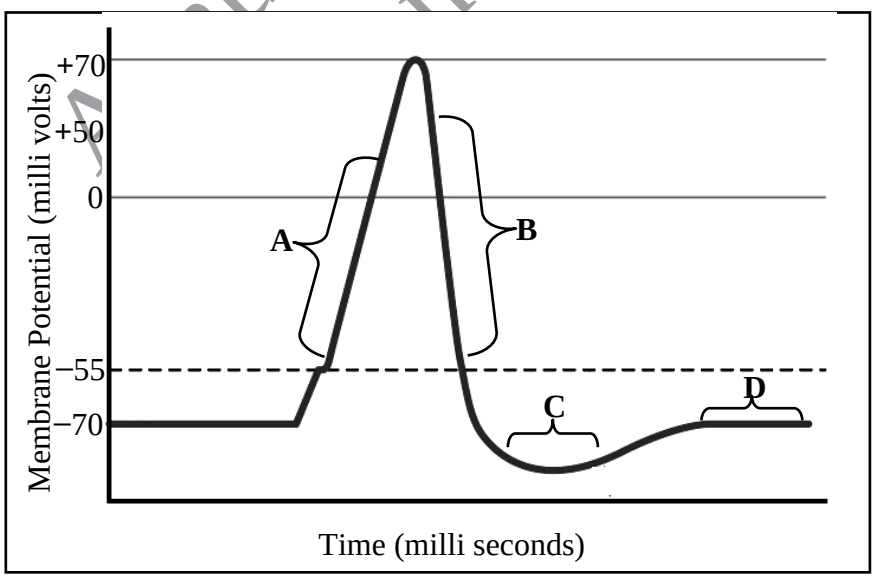
11. The given diagrams, **I** and **II**, show the growth of plant without and with hormone treatment.



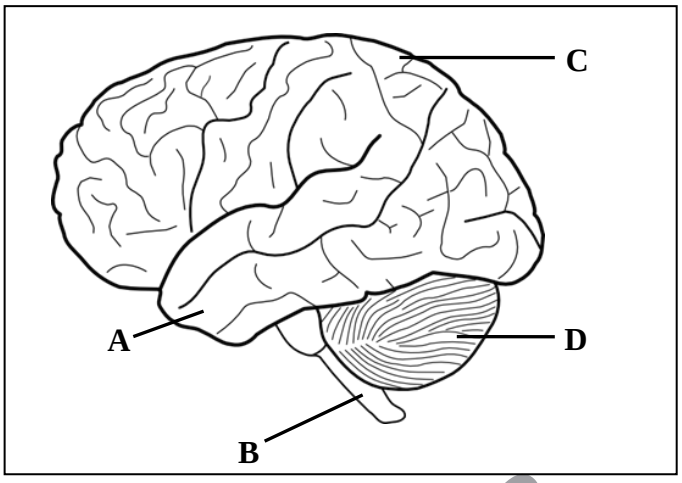
Based on the shown effect in diagram **II**, the hormones used in the mixture must be

A. ethene and auxin.
B. auxin and gibberellin.
C. abscisic acid and ethene.
D. gibberellin and abscisic acid.

12. In the given graph of action potential, the labelled part which indicates the resting membrane potential of a neuron is



13. In the given diagram of human brain, the labelled part that acts as a vital reflex centre for respiration and cardiovascular function is



14. In a neuron, Nissls' granules are found in the cytoplasm of the cell body. These granules are composed of

A. free ribosomes, mitochondria and lysosomes.
B. mitochondria, peroxisomes and Golgi bodies.
C. lysosomes, peroxisomes and rough endoplasmic reticulum.
D. free ribosomes, rough endoplasmic reticulum and Golgi bodies.

15. A water flask had a very low level of water. A crow dropped pebbles in the flask to raise the water level enough so that it can drink the water.

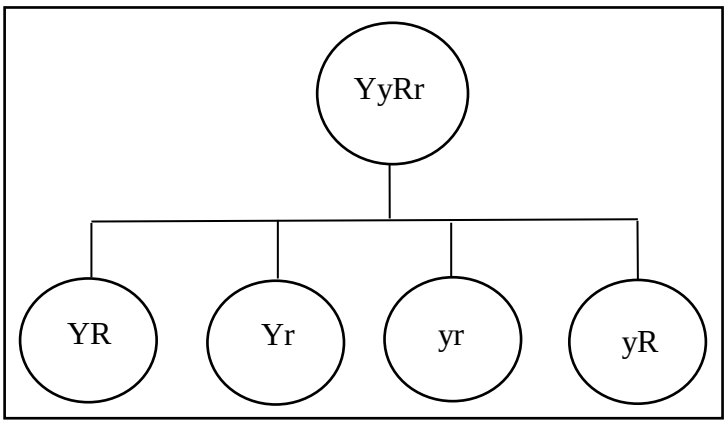
The type of learning behaviour exhibited by the crow in the given situation is

A. imprinting.
B. latent learning.
C. insight learning.
D. conditioned reflex type I.

16. An example of epistasis is

A. human height is controlled by 180 genes.
B. gene E hides the effect of coat colour gene in dogs.
C. human blood groups are determined by three alleles.
D. the gene for flower colour in pea plant also affects the seed coat colour.

17. The given diagram of separation of alleles during gamete formation exemplifies the



A. sex-linked inheritance.
B. inheritance of single trait.
C. Hardy-Weinberg principle.
D. Mendel's law of independent assortment.

18. The patient with sickle cell anaemia has red blood cells with an abnormal form of haemoglobin.

The gene for haemoglobin exists in two forms:

- H^N = dominant allele for normal haemoglobin
- H^S = recessive allele for abnormal haemoglobin

If 50% of the children of a couple have sickle cell anaemia, then the genotype of the couple would be

A. $H^N H^S$, $H^S H^S$.
B. $H^N H^N$, $H^N H^S$.
C. $H^N H^N$, $H^S H^S$.
D. $H^N H^S$, $H^N H^S$.

19. Eye colour in drosophila is an X-linked trait in which red eye colour is dominant over white eye colour.

When a white-eyed male drosophila crosses with a red-eyed heterozygous female drosophila, then the type of offspring that would NOT produce are

A. red-eyed males.
B. white-eyed males.
C. red-eyed homozygous females.
D. white-eyed homozygous females.

20. Consider the given cross between two cats.

BBLl (black and long-haired)	×	bbll (white and short-haired)

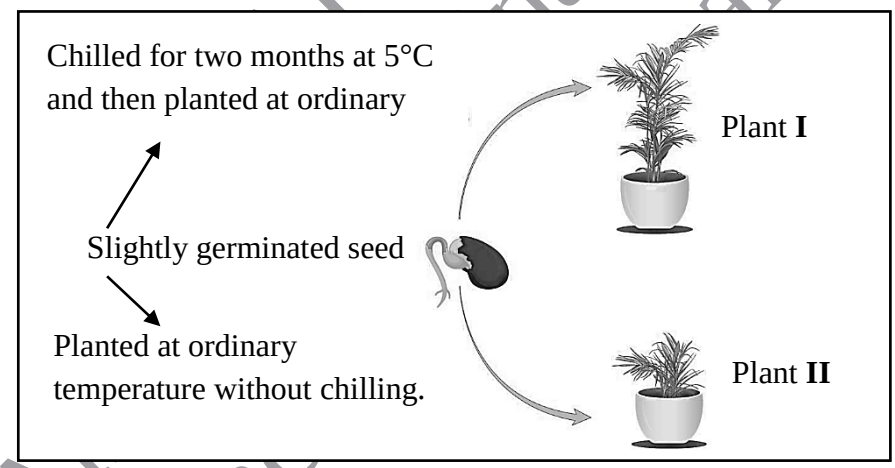
The probability of the offspring cats produced by this cross would be

A. 100% black long-haired.
B. 75% black long-haired and 25% black short-haired.
C. 50% black long-haired and 50% black short-haired.
D. 25% black long-haired and 75% black short-haired.

21. Suppose a human egg is fertilised by a sperm. If, immediately after fertilisation, the zygote is divided into two separate cells, then this process would result in

A. fragmentation.
B. fraternal twins.
C. identical twins.
D. parthenogenesis.

22. Consider the given diagram.



The phenomenon which induces the growth of plant **I** is

A. vernalisation.
B. seed dormancy.
C. photoperiodism.
D. seed germination.

23. Unisexuality is MOST likely found in those animals which

A. live in aquatic environment.
B. lack protective hard eggshell.
C. exhibit incomplete metamorphosis.
D. have advance mode of sexual reproduction.

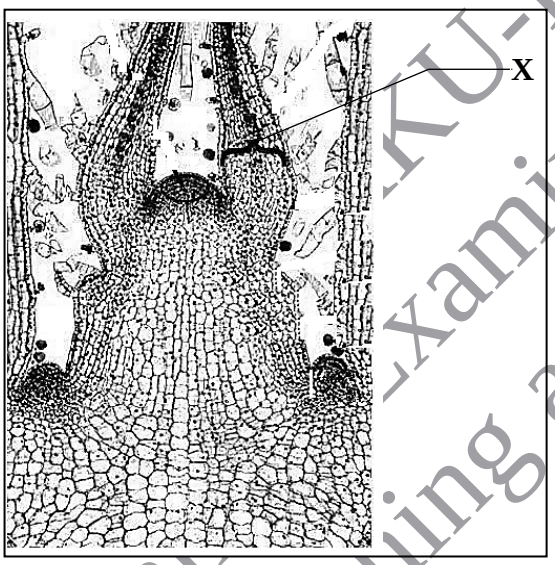
24. The option that identifies the plant's response provoked by red and blue light is

	Red Light	Blue Light
A	enhances cell division.	elongates cells.
B	elongates cells.	enhances cell division.
C	enhances cell division.	retards cell enlargement.
D	elongates cells.	retards cell division.

25. In a chick embryo, somites are formed from

A. dorsal mesoderm.
B. somatic mesoderm.
C. splanchnic mesoderm.
D. lateral plate mesoderm.

26. The given diagram shows the histology of a developing shoot of a plant.



The labelled structure **X** gives rise to

A. bark.
B. leaves.
C. lateral shoots.
D. vascular cambium.

27. Consider the given table related to four DNA nucleotides (**I**, **II**, **III** and **IV**).

Nucleotide	Number of Ring in Nitrogenous Base	Ratio of Carbon to Oxygen Atoms in Pentose Sugar
I	Single	1:1
II	Single	5:4
III	Double	1:1
IV	Double	5:4

During DNA duplication, the nucleotide that can pair with an adenine base is

A. I.
B. II.
C. III.
D. IV.

28. A section of a double-stranded DNA contains 150 nucleotides and codes for a polypeptide **X**.

The number of amino acids in polypeptide **X** will be

A. 25
B. 50
C. 75
D. 150

29. The given table shows the genetic codes of two different amino acids which exemplifies one of the features of genetic codes.

Amino Acid	Genetic Code
Phenylalanine	Two codes UUU and UUC
Leucine	Four codes CUU, CUC, CUA, and CUG

Which of the following statements is CORRECT about this feature?

A. Genetic codes are redundant.
B. Genetic codes are ambiguous.
C. Each amino acid has only one genetic code.
D. Three genetic codes are used for stop signal.

30. The table below shows sequence of nucleotides on a chromosome before and after mutation.

Before Mutation	After Mutation
GCCTAATCG	GCCATATCG

The type of mutation in the given case is

A. deletion.
B. insertion.
C. substitution.
D. transposition.

31. In the study of mitosis, colchicine is a chemical used to cease mitotic cell division at metaphase.

The effect of this chemical on the succeeding stages is that the

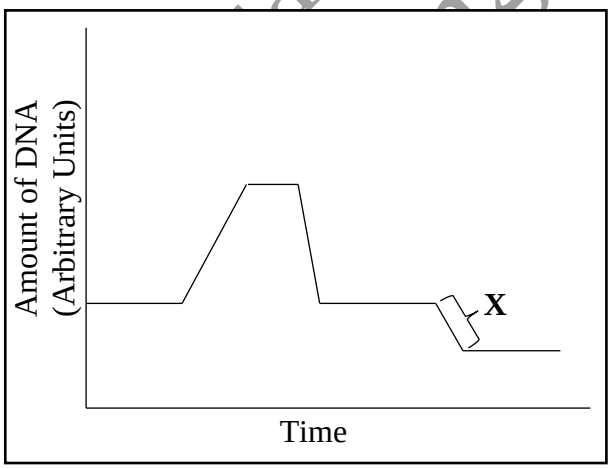
A. chromatin will not condense.
B. nuclear membrane will not disappear.
C. centrioles will not move to the opposite poles.
D. migration of chromatids to the opposite poles will be halted.

32. Gangrene is the localised death of body tissues that often occurs in people with diabetes who unknowingly injure a toe or foot.

Gangrene is an example of

A. mitosis.
B. meiosis.
C. necrosis.
D. apoptosis.

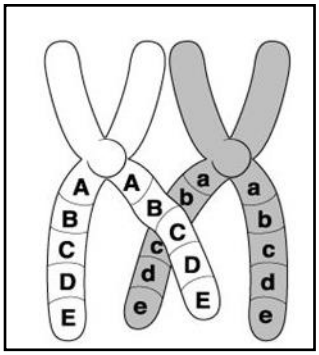
33. The given graph depicts the changes in the amount of DNA per nucleus during cell cycle.



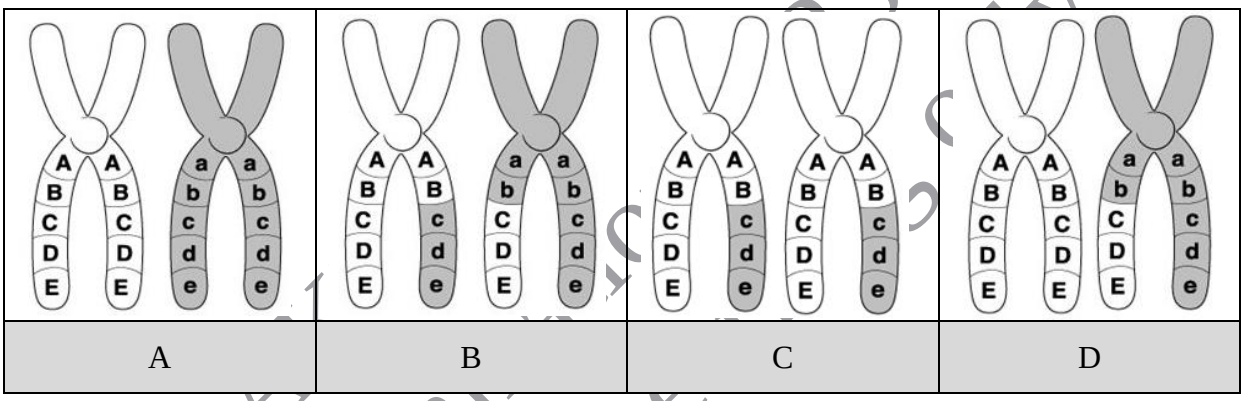
The labelled region **X** represents

A. mitosis.
B. meiosis.
C. S-phase.
D. G2 phase.

34. The given diagram shows crossing over during meiosis.



The diagram that identifies the outcome of this crossing over is



A	B	C	D

35. In genetic engineering, DNA probes are used to

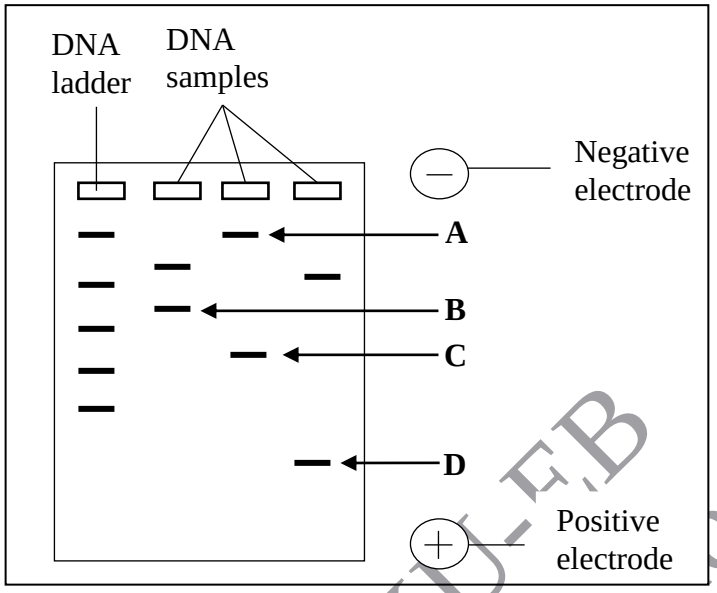
A. clone a DNA fragment.
B. isolate a gene from the bacterium.
C. detect the presence of mutation in a gene.
D. search for a certain gene in a genetic library.

36. In Sanger's DNA sequencing method, dideoxy ribonucleotides are used as chain terminators because they lack

A. hydrogen at 2' carbon, which is required for the formation of hydrogen bond.
B. OH group at 3' carbon, which is required for the formation of phosphodiester bond.
C. nitrogenous base at 1' carbon, which is required for the formation of hydrogen bond.
D. phosphate group at 5' carbon, which is required for the formation of phosphodiester bond.

37. The given diagram shows the separation of DNA fragments of different sizes by using gel electrophoresis method.

The DNA fragment that is largest in size is labelled as



38. To protect a farm animal from a plant toxin, a gene for resistance to the toxin was transferred to the farm animal.

Which technique is used to obtain this objective?

A. Cloning
B. Tissue culture
C. Gene Therapy
D. Genetic engineering

39. The given data shows the coat colour and allele frequency of a population of rabbits which is supposed to be in Hardy-Weinberg equilibrium.

Coat Colour (Allele)	Allele Frequency
White (C)	0.19
Grey (c)	0.81

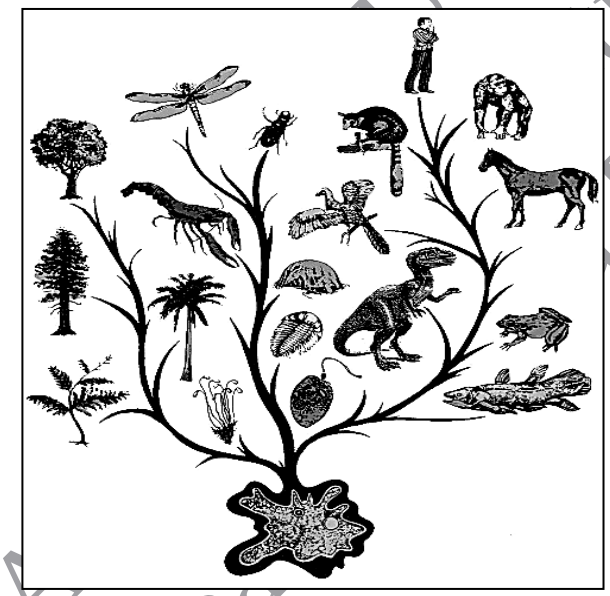
The percentage of heterozygous individuals in the given population is

A. 2%.
B. 15%.
C. 31%.
D. 36%.

40. With reference to evolution of organisms, which of the following options CORRECTLY matches the example with the related type of structure and the type of evolution?

	Example	Type of Structure	Type of Evolution
A	Wings of insects and birds	Homologous	Convergent
B	Wings of bat and arms of monkey	Homologous	Divergent
C	Wings of bat and arms of monkey	Analogous	Convergent
D	Wings of insects and birds	Analogous	Divergent

41. Consider the given diagram.



The aspect of Darwin's theory of evolution that is depicted in the given diagram is

A. struggle for existence.
B. descent with modification.
C. inheritance of acquired characters.
D. production of more species than the environment can support.

42. Acquired characteristics are non-inheritable because they do NOT cause alteration in the

A. cytoplasmic composition of somatic cells.
B. cytoplasmic composition of germ cells.
C. DNA of somatic cells.
D. DNA of germ cells.

43. The CORRECT exemplification of an abiotic factor in an ecosystem is

A. fish in a river.
B. minerals in soil.
C. mosquito larva in a pond.
D. orchids in tropical rainforest.

44. The first stage of primary succession in an ecosystem is the pioneer community.

The characteristic feature(s) of a pioneer community is/ are

I. the biomass starts to increase
II. energy consumption is efficient
III. major species are lichens and mosses

A. I only.
B. II only.
C. I and III.
D II and III.

45. Denitrifying bacteria do not necessarily require oxygen for respiration; therefore, they are abundantly found

A. in well-aerated soils.
B. in water-logged soil.
C. in root nodules of leguminous plants.
D. on the root surfaces of leguminous plants.

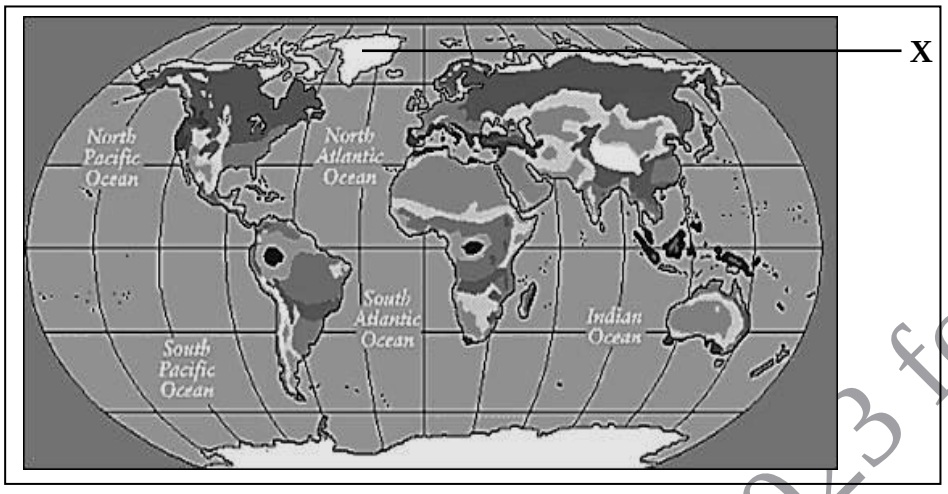
46. In evergreen coniferous trees, presence of small, waxy and needles-like leaves is significant to

A. allow snow to build up on their branches.
B. produce more wind resistance in cold season.
C. capture maximum sunlight for photosynthesis.
D. reduce water loss by evaporation during cold season.

47. In addition to frequent fires, the factors that maintain grass land biome are

A. acidic soil and low rainfall.
B. high temperature and acidic soil.
C. high rainfall and low temperature.
D. low rainfall and grazing by animals.

48. The given diagram shows the location of biomes on the globe.



The biome **X** is identified as

A. tundra.
B. grassland.
C. temperate rain forest.
D. temperate deciduous forest.

49. A group of environmental biologists work for the establishment of forests in the previously barren lands. The effort of these biologists exemplifies

A. reduction.
B. recycling.
C. afforestation.
D. deforestation.

50. In fresh water bodies, eutrophication occurs due to the accumulation of

A. toxic gases.
B. heavy metals.
C. plastic garbage.
D. inorganic nutrients.

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