Please check the examination details below before entering your candidate information

Candidate Name	Class	Section

BLOOM Biology Olympiad (BBO)

Question Paper 2024-25

Class 12

Total Questions: **50+5** (Tie-Breaking Section)

Total Time Allotted : 60 minutes

Total Marks : 60

Instructions

1. There are **50 Multiple Choice Questions** in this booklet having 4 options out of which **ONLY ONE** is correct.
2. There are two sections in the Question Paper; **Section A** having 40 Questions carrying 1 Mark each & **Section B** having 10 Higher Difficulty Order Questions carrying 2 Marks each.
3. All questions are compulsory. There is **NO negative** marking for incorrect answers.
4. Total time allotted to complete the paper is 60 minutes.
5. Please fill in your details in the space provided on this page before attempting the paper.

OMR Sheet Instructions

1. Before starting the paper, fill in all the details in the OMR Sheet.
2. Additional 10 minutes will be provided to fill up the OMR sheet, before the start of the exam.
3. Use HB Pencil to darken the circle of the correct Option in OMR sheet. The correct way to darken the circle in OMR sheet is shown below.

4. Use black or blue ball point pen/HB pencil to fill the information in the OMR sheet. Partially filled OMR sheet will not be checked.
5. Return the OMR sheet to the invigilator after the exam.

Code#171

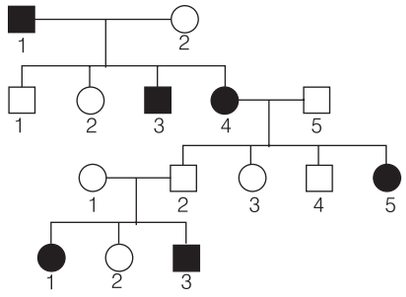
B12

BLOOM CAP

Founded by | arihant

Section A (1 Mark)

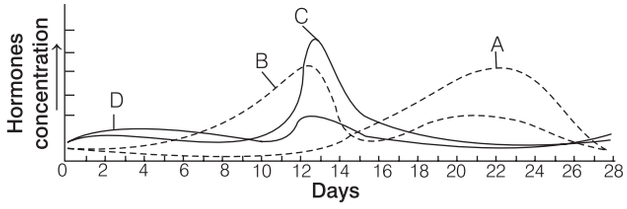
1. A family pedigree for a rare body trait is shown below. The affected persons are shown as filled symbols.



The inheritance pattern of the trait is most likely to be

(a) X-linked recessive
(b) autosomal recessive
(c) X-linked dominant
(d) autosomal dominant with incomplete penetrance

2. Below is a diagrammatic representation showing the levels of various hormones throughout the menstrual cycle.



Choose the incorrect option with respect to A, B, C and D.

(a) A: responsible for the initial development of the ovarian follicles
(b) B: governs the development of female secondary sexual trait
(c) C: stimulates hormone production in the ovaries and testes
(d) D: drives the maturation of gametes in females

3. Identify the odd one out in each of the following series.

Series I: Cu-T, Multiload 375, Cu7 and LNG-20
Series II: Diaphragms, vaults, cervical caps and Lippes loop
Series III: Abstinence, tubectomy, withdrawal and lactational amenorrhea.

Choose the correct answer from the options given below:

(a) Vaults, Cu-7 and withdrawal
(b) Cu-T, abstinence and lactational amenorrhea
(c) Lippes loop, tubectomy and LNG-20
(d) Multiload 375, abstinence and diaphragms

4. Given a laboratory analysis of various nucleic acids, which of the following options would be identified as a double-stranded DNA (*ds*DNA) molecule?

(a) Adenine-28%, Cytosine-22%, Guanine-22%, Uracil-28%
(b) Adenine-28%, Cytosine-28%, Guanine-22%, Uracil-22%
(c) Adenine-28%, Cytosine-22%, Guanine-22%, Thymine-28%
(d) Adenine-28%, Cytosine-28%, Guanine-22%, Thymine-22%

5. A sexual reproducing organism has the genotype AaBbCcDd. How many unique haploid gametes can this organism generate?

(a) 4 (b) 8
(c) 16 (d) 18

6. Which of the following statements is not correct?

(a) Insects that consume pollen or nectar without bringing about pollination are called pollen nectar robbers
(b) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil
(c) Some reptiles have also been reported as pollinators in some plant species
(d) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style

7. A cross between two true breeding lines one with dark blue flowers and one with bright white flowers produces F_1 offspring that are light blue. When the F_1 progeny are selfed, a 1:2:1 ratio of dark blue to light blue to white flowers is observed. What genetic phenomenon is consistent with these results?

(a) Epistasis (b) Incomplete dominance
(c) Co-dominance (d) Inbreeding depression

8. Given that the cells of the endosperm in plant X contain six sets of chromosomes, what would be the ploidy of the synergids, filiform apparatus and central cell in this plant?

(a) *n*, *n* and *n* (b) 2*n*, 2*n* and 2*n*
(c) *n*, *n* and 2*n* (d) 2*n*, 2*n* and 4*n*

9. Which method would you select to accurately diagnose the presence of a venereal disease?

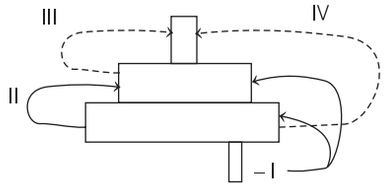
I. ELISA
II. PCR
III. Gel electrophoresis
IV. DNA hybridisation
V. RFLP

Choose the correct option from the list below.

(a) I, II and IV (b) II, III and IV

(c) I, IV and V (d) II, IV and V

10. Biomass pyramid of a terrestrial ecosystem is shown. Arrows indicate energy transfer at various levels.



The major energy transfer occurs at

(a) I (b) II

(c) III (d) IV

11. Identify correct statement out of four given below are correct.

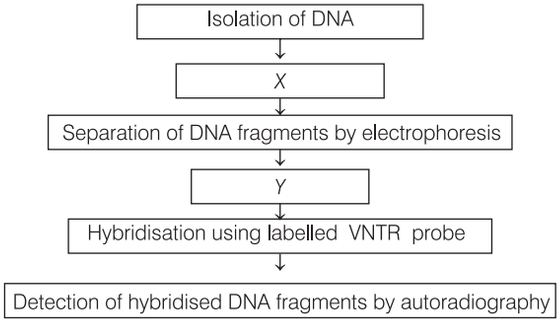
(a) In prokaryotes, DNA polymerase-III carries out both initiation and elongation.

(b) Gyrase functions in negative supercoiling during DNA replication of eukaryotes.

(c) Nitrogen bases of two polynucleotide chains form complementary pairs.

(d) Prokaryotic DNA is usually circular, double stranded with exon and introns.

12. Which of the following option, correctly fill in the space below.



(a) X- Digestion of RNA by restriction endonucleases, Y- Transferring (blotting) of separated RNA fragments to synthetic membranes

(b) X- Digestion of DNA by restriction endonucleases, Y- Transferring (blotting) of separated DNA fragments to synthetic membranes

(c) X- Digestion of DNA by restriction exonucleases, Y- Transferring (blotting) of separated DNA fragments to synthetic membranes

(d) X- Digestion of DNA by restriction exonucleases, Y- Transferring (blotting) of separated DNA fragments to natural membranes

13. Oogenesis is the process of formation of a mature female gamete, initiated during the

(a) puberty of female

(b) embryonic development stage of female

(c) menstrual cycle of an adult female

(d) gestation period of an female

14. A researcher is studying a gene in a plant species. The DNA coding strand for the gene segment under investigation is as follows:

5′-ATGGCTAAGTTTTGA-3′

Given the sequence, which of the following represents the correct sequence of amino acids translated from this DNA sequence?

(a) Met - Ala - Lys - Phe - Stop

(b) Met - Gly - Lys - Phe - Stop

(c) Met - Ala - Lys - Leu - Stop

(d) Met - Ala - Asp - Phe - Stop

15. Arrange the following milestones in human evolution in their correct chronological order, considering their development over time.

1. Use of hides for protection
2. Emergence of prehistoric cave art
3. Adoption of agricultural practices
4. Development and use of stone tools

Options:

(a) $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$ (b) $2 \rightarrow 1 \rightarrow 4 \rightarrow 3$

(c) $4 \rightarrow 1 \rightarrow 2 \rightarrow 3$ (d) $1 \rightarrow 4 \rightarrow 2 \rightarrow 3$

16. Given below is some information about genetically engineered insulin. Choose the correct statements.

(a) Pro-hormone insulin contains extra stretch of C-peptide

(b) A-peptide and B-peptide chains of insulin were produced separately in *E. coli*, extracted and combined by creating peptide bond between them.

(c) Insulin used for treating diabetes was extracted from cattle and pigs.

(d) Pro-hormone insulin needs to be processed for converting into a mature and functional hormone.

17. Which is the most common type of embryo sac in angiosperms?

(a) Tetrasporic with one mitotic stage of divisions

(b) Monosporic with three sequential mitotic divisions

(c) Monosporic with two sequential mitotic divisions

(d) Bisporic with two sequential mitotic divisions

18. Which of the following option correctly describes how *Bt* cotton plants protect themselves from the pests targeted by the *Bt* toxin?

(a) The *Bt* toxin is produced in an inactive form within the cotton plants and is activated only when ingested by insects, which prevents harm to the plants themselves.

(b) The *Bt* toxin is produced in an active form outside the cotton plants and when ingested by insects, prevents harm to the plants themselves

(c) The *Bt* toxin is produced in an active form within the cotton plants and is only harmful to insects due to a specific cellular defence mechanism in the plants.

(d) The *Bt* toxin is produced in the active form and gets inactivated in the gut of certain insects.

19. Read the following statements carefully and choose the incorrect statement.

(a) Cyclosporin-A is used as an immunosuppressive agent in organ-transplant patients, is produced by the algal *Trichoderma polysporum*.

(b) Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents.

(c) Yeast (*Saccharomyces cerevisiae*) is used for commercial production of ethanol.

(d) Streptokinase produced by the bacterium *Streptococcus* and modified by genetic engineering is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack.

20. Which of the following statement correctly describe the primary function of anaerobic sludge digesters and the byproduct generated in the wastewater treatment process?

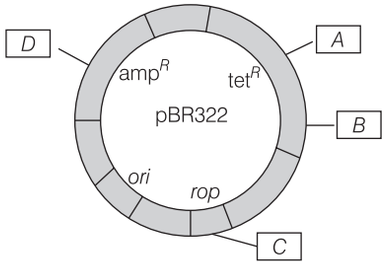
(a) To further decrease Biological Oxygen Demand (BOD) by using aerobic bacteria, resulting in a more stable and less odorous sludge.

(b) To separate solid waste from liquid effluent, producing clean water and a nutrient-rich sludge.

(c) To digest the activated sludge with anaerobic bacteria, generating biogas that can be utilised as an energy source.

(d) To remove harmful chemicals and heavy metals, creating a safer sludge that is easier to dispose of.

21. Refer to the given figure and identify *A, B, C* and *D*.



(a) *A–Bam* HI, *B–Sal* I, *C-Pvu* II and *D–Pst* I

(b) *A–Bam* HI, *B–Sal* I, *C–Pvu* I and *D–Pst* I

(c) *A–Bam* HI, *B–Sal* I, *C–Pst* I and *D–Pvu* I

(d) *A–Bam* HI, *B–Cla* I, *C–Pvu* II and *D–Pvu* I

22. Three siblings have the following blood groups: B Rh positive; A Rh negative; and O Rh positive. Based on this information what will be the parents' genotype for the two blood group loci?

(a) $I^A I^B + -$ and I^A i + – (b) I^B i + + and I^A i + –

(c) I^B i + – and I^A i – – (d) $I^A I^B + +$ and ii + –

23. A farmer wants to grow *Citrus* and mango in his field. He wants the progeny of *Citrus* and mango would be identical to their parents. Which of the following cell of the ovule would solved his problem?

(a) Egg cell (b) Nucellus cell

(c) Micropylar cell (d) Antipodal cell

24. Given 50 primary oocytes and 100 secondary spermatocytes undergoing meiosis, determine the total number of functional sperm and ova that can be produced.

(a) 50 ova and 200 sperms

(b) 25 ova and 200 sperms

(c) 50 ova and 50 sperms

(d) 25 ova and 100 sperms

25. In natural populations, individual allele frequencies are changing all the time. Several factors can be responsible for change in allele frequency. Among these, the only factor that produces adaptive evolutionary changes is

(a) random mutation

(b) immigration and emigration

(c) natural selection

(d) genetic drift

26. Which of the following hormone level will cause release of ovum (ovulation) from the Graafian follicle?

(a) High concentration of progesterone

(b) Low concentration of LH

(c) Low concentration of FSH

(d) High concentration of oestrogen

27. In a dihybrid cross involving two linked genes, where gene A has alleles A and a, and gene B has alleles B and b, assume that the genes are located on the same chromosome and exhibit complete linkage. If a parent with genotype AaBb produces gametes, how many types of gametes will be produced and what is their distribution?

(a) 2 types of gametes: AB and ab, with each type appearing with 50% frequency.

(b) 4 types of gametes: AB, Ab, aB and ab, with each type appearing with 25% frequency.

(c) 2 types of gametes: AB and ab, with AB appearing with 75% frequency and ab with 25% frequency.

(d) 4 types of gametes: AB, Ab, aB and ab, with AB and ab each appearing with 50% frequency.

28. X and Y are plant-based drugs where X acts as a depressant, slowing down body functions, and Y induces a sense of euphoria and boosts energy. If both X and Y are administered through snorting, identify the correct match from the following options.

(a) X: Cannabinoid- Interact with cannabinoid receptor in the brain.

(b) Y: Cocaine- Interferes with transport of dopamine

(c) Y: Smack- Interact with opioid receptor present in central nervous system

(d) X: Crack- Interact with receptors in gastrointestinal tract

29. Thalassemia is an autosomal recessive disorder, and a couple both carry one allele for thalassemia (heterozygous carriers). If they have a child, what is the probability that their child will be a male affected by thalassemia?

(a) 12.5% probability, considering both the chance of the child being affected and being male.

(b) 25% probability, as it only considers the child being affected by thalassemia.

(c) 50% probability, considering the child being affected and being male.

(d) 75% probability, taking into account both the probability of the child being affected and being male.

30. Match the following columns.

Column I	Column II
A. Filariasis	1. Stool with excess mucus and blood clot
B. Amoebiasis	2. Chronic inflammation of organs
C. Ringworm	3. Blockage of intestinal blocking
D. Ascariasis	4. Scaly lesions on various body parts

Choose the correct answer.

	A	B	C	D			A	B	C	D
(a)	2	1	4	3		(b)	3	2	1	4
(c)	1	3	2	4		(d)	4	2	1	3

31. Given below is a matrix of possible interaction beneficial (+), harmful (–), neutral (0) between species 1 and 2. The names of interactions A, B, C and D respectively are:

Species 2	Species 1			
		0	+	–
	+	D	C	B
	–		A	

(a) Predation, competition, mutualism and commensalism

(b) Mutualism, competition, amensalism and commensalism

(c) Competition, commensalism, predation and mutualism

(d) Predation, mutualism, commensalism and amensalism

32. The frequency of AB blood types in a population of 8243 individuals is as follows:

Blood type	Genotype	Number of individuals
A	I^AI	2386
AB	I^AI^B	4265
B	I^BI	1592

The frequency of I^A allele in this population is

(a) 0.8068 (b) 0.8689

(c) 0.6234 (d) 0.6583

33. Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.

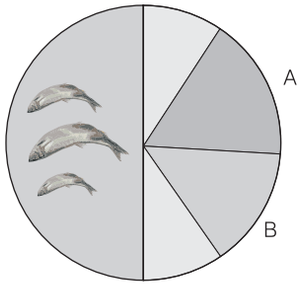
(a) A person will have only two of the three alleles

(b) When I^A and I^B are present together, they express same type of sugar

(c) Allele 'i' does not produce any sugar

(d) The gene I has three alleles

34. Identify the correct option with respect to A and B in the figure given below representing proportionate number of major vertebrate taxa.



(a) A and B both are endotherm

(b) A– Endotherm; B – Ectotherm

(c) A and B both are ectotherm

(d) A– Ectotherm; B– Endotherm

35. Which of the following statement accurately describes a method for introducing recombinant DNA into host cells, and correctly pairs the method with its application?

(a) Micro-injection: Utilises a gene gun to deliver DNA-coated particles into plant cells.

(b) Biolistic: Directly injects recombinant DNA into the nucleus of animal cells.

(c) Disarmed pathogen vectors: Employs modified pathogens to transfer recombinant DNA into host cells.

(d) Electroporation: Bombards cells with gold or tungsten particles coated with DNA

36. Which of the following statement best describes the typical characteristics of secondary effluent after biological treatment?

(a) It contains a high concentration of anaerobic bacteria and exhibits low Biochemical Oxygen Demand (BOD).

(b) It has a high concentration of aerobic bacteria and remains high in Biochemical Oxygen Demand (BOD).

(c) It exhibits a high concentration of aerobic bacteria but still maintains a relatively high Biochemical Oxygen Demand (BOD).

(d) It has low concentrations of aerobic bacteria and a high Biochemical Oxygen Demand (BOD).

37. A couple faces infertility due to the female partner's blocked Fallopian tubes and the male partner's very low sperm count. Which ART approach best addresses both issues by allowing fertilisation outside the body and using a technique to directly inject sperm into the egg?

(a) Intrauterine Insemination (IUI) with egg donation

(b) *In Vitro* Fertilisation (IVF) with Intra Cytoplasmic Sperm Injection (ICSI) and blastocyst culture

(c) Gamete Intra Fallopian Transfer (GIFT) with oocyte aspiration

(d) Zygote Intra Fallopian Transfer (ZIFT) with cryopreserved sperm

38. Sophia, a 40-year-old woman who smokes, presents with a persistent dry cough, shortness of breath, unexplained weight loss, and night sweats. A chest X-ray reveals multiple lung nodules and she exhibits clubbing of the fingers. Which of the following conditions is most consistent with Sophia's symptoms and chest X-ray findings?

(a) Chronic bronchitis (b) Pulmonary fibrosis

(c) Lung cancer (d) Sarcoidosis

39. How many of the following tools are essential for performing Polymerase Chain Reaction (PCR)? Count the number of tools that are correctly required.

i. DNA template ii. Potassium ions

iii. Primers iv. *Taq* polymerase

v. RNA polymerase

vi. *d*NTPs (Deoxynucleotide Triphosphates)

vii. $MgCl_2$ (Magnesium chloride)

viii. Heat-resistant RNA polymerase

(a) 3 (b) 4 (c) 5 (d) 6

40. In rabbits, two genes A and B are present on two different chromosomes. Products of both wild type A and B genes are essential for normal hearing. Homozygous recessive mutants either for A, B or both results in deafness. If a double heterozygous male (AaBb) is crossed with a double heterozygous female, the ratio of phenotypically normal and deaf rabbits will be

(a) 15:1 (b) 7:9 (c) 9:7 (d) 13:3

Section B (2 Marks)

Direction (Q.Nos. 41- 44) : Given below are two statements; one is labelled as Assertion (A) and other is labelled as Reason (R) of the given statements choose the correct option as

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true, but R is not the correct explanation of A

(c) A is true, but R is false

(d) A is false, but R is true

41. **Assertion** (A) Geitonogamy is considered a form of self-pollination because it involves the transfer of pollen from one flower to another on the same plant.

Reason (R) Geitonogamy results in genetic variation because pollen transfer occurs between different flowers on the same plant, promoting cross-pollination within a single organism.

42. **Assertion** (A) The gametogenesis in females completes after the fusion of sperm and ovum.

Reason (R) The entry of sperm into the ovum results in the formation of an ootid and second polar body.

43. **Assertion** (A) The innermost wall layer of microsporangium is tapetum which nourishes the developing pollen grains, these possess dense cytoplasm and generally have more than one nucleus.

Reason (R) The microsporangium is surrounded by four wall layers, epidermis, endothecium, middle layers and the tapetum.

44. **Assertion** (A) Chasmogamous flowers produce assured seed set, even in the absence of pollinators.

Reason (R) The chasmogamous flowers are with exposed anthers and stigma so that cross-pollination can occur.

45. Read the following statements and select the correct option.

Statement I Infertility cases where the male partner has low sperm count can be helped by artificial insemination.

Statement II In artificial insemination technique, the ova from the female and the sperms from the male are collected and induced to form zygote in the laboratory.

Choose the correct answer from the options given below.

(a) Both statement I and statement II are correct.

(b) Both statement I and statement II are incorrect.

(c) Statement I is correct, but statement II is incorrect.

(d) Statement I is incorrect, but statement II is correct.

46. Evaluate the following statements about cancer and determine which option correctly identifies the true and false statements.

I. Mutations in tumour suppressor genes can lead to the loss of normal cellular control mechanisms, resulting in unchecked cell proliferation and tumour formation.

II. The activation of oncogenes results in the inhibition of cell division and enhancement of apoptosis, reducing the likelihood of tumour development.

III. The process of metastasis involves the spread of cancer cells from the primary tumour to distant organs, where they form secondary tumours.

IV. Inactivation of tumour suppressor genes often results in the promotion of apoptosis and inhibition of cell cycle progression.

Which of the following option accurately represents the correctness of these statements?

(a) Statements 1 and 3 are true, while statements 2 and 4 are false

(b) Statements 2 and 4 are true, while statements 1 and 3 are false

(c) Statements 1 and 4 are true, while statements 2 and 3 are false

(d) Statements 3 and 4 are true, while statements 1 and 2 are false

Direction (Q. Nos. 47-50) Read the following and answer the questions given below.

Sarah, a 28-year-old healthcare worker, recently travelled to a region with a high prevalence of hepatitis-A. As a child, she received the hepatitis vaccine and her job requires her to work with patients who have hepatitis-A. After returning from her trip, Sarah develops mild symptoms consistent with hepatitis-A. Her physician decides to check her immunity status through a blood test.

47. Sarah's recent mild symptoms are similar to those of hepatitis-A. Which of the following best describes the nature of the immunity Sarah's vaccination conferred?

(a) The vaccination provided passive artificial immunity that may have waned over time.

(b) The vaccination induced active artificial immunity, which could be compromised if she was exposed to a high dose of the virus.

(c) The immunity from the vaccine was passive natural, as it involved antibodies from another source.

(d) The vaccine only provided temporary immunity, and her symptoms suggest that it was ineffective.

48. If Sarah received a booster vaccine dose but still develops symptoms, which type of immune cell response might be lacking?

(a) Increased cytotoxic T-cells to target and destroy infected cells.

(b) Effective activation of B cells to produce antibodies.

(c) Enhanced natural killer cell activity to detect and eliminate infected cells.

(d) Proper function of regulatory T-cells to control inflammation.

49. If a blood test shows elevated levels of memory B cells, but low levels of antibodies against hepatitis-A, what could be the reason?

(a) Memory B-cells are present but not effectively differentiating into antibody-producing plasma cells.

(b) Memory B-cells have been activated, but are undergoing apoptosis before mounting a full response.

(c) Antibodies are being produced, but may not be detectable due to a testing error.

(d) Elevated memory B cells might indicate recent exposure rather than an effective vaccine response.

50. If Sarah had received hepatitis-A immune globulin rather than a vaccine booster, which of the following statements best describes the impact on her lymphocytes?

(a) Immune globulin would directly stimulate B-cells to produce antibodies.

(b) Immune globulin provides passive immunity without involving the recipient's lymphocytes in antibody production.

(c) Immune globulin enhances the activation of T-cells to fight the infection.

(d) Immune globulin would increase the number of natural killer cells to combat the virus.

Tie-Breaking Section

Instructions

1. This section consists of 5 questions.
2. The score achieved in this section will not be included in the total marks.
3. If overall marks of two or more students are same, winner will be decided based on the score in this section.
4. Participation in this section is optional, and students may choose to attempt it or not.

1. What is the fate of the male gametes discharged in the synergid?

(a) One fuses with the egg and other fuses with central cell nuclei

(b) One fuses with the egg, other(s) degenerates in the synergid

(c) All fuse with the egg

(d) One fuses with the egg, other(s) fuses with synergid nucleus

2. In *Antirrhinum* (snapdragon), a red flower was crossed with a white flower and in F_1-generation, pink flowers were obtained. When pink flowers were selfed, the F_2-generation showed white, red and pink flowers. Choose the incorrect statement from the following.

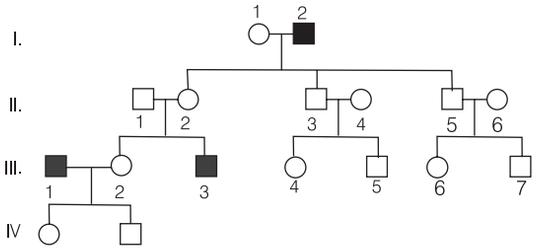
(a) Pink colour in F_1 is due to incomplete dominance

(b) Ratio of F_2 is $\frac{1}{4}$ (Red) : $\frac{2}{4}$ (Pink) : $\frac{1}{4}$ (White)

(c) Law of segregation does not apply in this experiment

(d) This experiment does not follow the principle of dominance

3. Based on the pedigree shown below, choose the correct option regarding the transmission of the trait for the rare human skin disease:



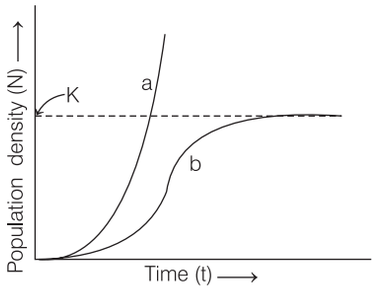
(a) The trait appears intermittently across generations and is expressed only in individuals with two copies of the dominant allele.

(b) The trait manifests in every generation, but is only expressed when both parents are carriers of the dominant allele.

(c) The trait primarily affects females and can be inherited through unaffected males in previous generations.

(d) The trait is seen in both males and females, often skipping generations, and requires two copies of the recessive allele to be expressed.

4. Observe the given graph and choose the correct answer.



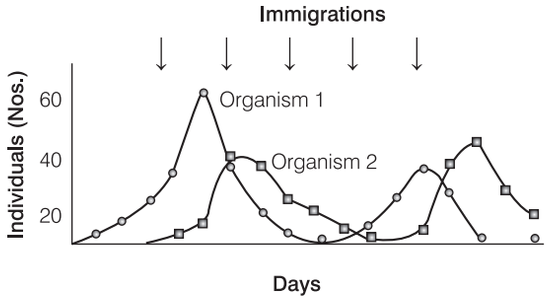
(a) In this population growth curve, ''a'' represents when responses are not limiting the growth, i.e., plot is logistic, and ''b'' represents when responses are limiting the growth, i.e., plot is exponential

(b) In this population growth curve, ''a'' represents when responses are limiting the growth and "b" represents when responses are not limiting the growth

(c) In this population growth curve, ''a'' represents when responses are not limiting the growth, i.e., plot is exponential, and "b" represents when responses are limiting the growth, i.e., plot is logistic

(d) In this population growth curve, ''b'' represents when responses are not limiting the growth, i.e., plot is exponential, and "a" represents when responses are limiting the growth, i.e., plot is logistic

5. In the following diagram, the interaction between two organisms 1 and 2 is shown in laboratory culture. At different intervals, individuals of both the species were introduced into culture to maintain their population density (like natural immigration process).



Which of the following statement/s is/are true for this inter-relationship?

I. If immigration is not there, population of both species will get exhausted within 6 to 10 days.

II. Organism 1 is most likely the predator of organism 2.

III. The graph shows normal curve of prey-predator relationship. Therefore, in this experiment, immigration of species from external source is not essential for co-existence of species.

IV. Organism 1 and 2 share a mutualistic relationship with each other.

(a) I and II (b) III and IV

(c) I only (d) IV only