Ultimate KCET Crash Course 2026

BOTANY

DPP: 1

Principles of inheritance and variation

Q1 In a cross between two pure contrasting pea plants differing in height, all offspring in the first generation exhibit only one parental trait. This observation is best explained by:
(A) Blending inheritance
(B) Equal expression of both factors
(C) Presence of dominant factor
(D) Mutation during gamete formation

Q2 The reappearance of a previously masked trait in the second generation indicates:
(A) Mutation
(B) Blending inheritance
(C) Segregation of factors
(D) Co-dominance

Q3 Which ratio represents the genotypic distribution in the second generation of a monohybrid cross?
(A) 3:1 (B) 1:1
(C) 1:2:1 (D) 2:1

Q4 The term used for alternative forms of the same hereditary unit controlling a character is:
(A) Chromosomes (B) Genes
(C) Alleles (D) Loci

Q5 Which condition results in intermediate phenotype in the first generation?
(A) Dominance
(B) Co-dominance
(C) Incomplete dominance
(D) Mutation

Q6 Which of the following best explains co-dominance?
(A) One allele suppresses another
(B) Both alleles express equally
(C) Only recessive expresses
(D) Alleles blend completely

Q7 A test cross is performed to determine:
(A) Phenotype
(B) Genotype of dominant individual
(C) Mutation rate
(D) Chromosome number

Q8 (Match the following)

Column I		Column II	
A.	Homozygous	i.	Different alleles
B.	Heterozygous	ii.	Identical alleles
C.	Alleles	iii.	Alternative forms
D.	Genotype	iv.	Genetic constitution

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

Q9 Statement I: Traits do not blend in inheritance.
Statement II: Both parental traits reappear unchanged in later generations.
(A) Both correct, II explains I
(B) Both correct, II not explanation
(C) I correct, II incorrect
(D) Both incorrect

Q10 Which situation leads to six genotypes but fewer phenotypes?
(A) Mutation
(B) Multiple alleles
(C) Linkage
(D) Crossing over

Q11 Which of the following explains absence of enzyme leading to recessive trait?
(A) Overproduction
(B) Functional enzyme
(C) Non-functional allele
(D) Co-dominance

Q12 Which condition arises due to failure of chromosome separation leading to abnormal chromosome number?
(A) Mutation (B) Polyploidy
(C) Aneuploidy (D) Crossing over

Q13 Match the following:

Column I		Column II	
A.	Colour blindness	1.	Enzyme deficiency
B.	Phenylketonuria	2.	Sex-linked defect
C.	Sickle cell anaemia	3.	Amino acid substitution
D.	Thalassemia	4.	Reduced globin synthesis

(A) A-2, B-1, C-3, D-4
(B) A-1, B-2, C-3, D-4
(C) A-2, B-3, C-1, D-4
(D) A-4, B-1, C-2, D-3

Q14 Match the following:

Column I		Column II	
A.	Down syndrome	1.	XXY
B.	Klinefelter syndrome	2.	XO
C.	Turner syndrome	3.	Trisomy 21
D.	Polyploidy	4.	Multiple chromosome sets

(A) A-3, B-1, C-2, D-4
(B) A-1, B-2, C-3, D-4
(C) A-3, B-2, C-1, D-4
(D) A-4, B-3, C-2, D-1

Q15 Which genetic condition involves defective blood clotting due to missing protein in cascade?
(A) Thalassemia
(B) Haemophilia
(C) Phenylketonuria
(D) Down syndrome

Q16 Which process increases chromosome sets instead of individual chromosomes?
(A) Aneuploidy (B) Mutation
(C) Polyploidy (D) Recombination

Q17 Which analysis method is most suitable for studying inheritance patterns in humans?
(A) Test cross
(B) Pedigree analysis
(C) Back cross
(D) Hybridisation

Q18 In honey bees, unfertilised eggs develop into males, while fertilised eggs develop into females. Males possess half the chromosome number compared to females and produce sperms by mitosis. Which genetic system does this describe?
(A) XO system
(B) XY system
(C) ZW system
(D) Haplodiploid system

Q19 Observe the sex determination in the following?
(I) Human males = XY
(II) Female hen = ZW
(III) Male Drosophila = XY
(IV) Male grasshopper = XO
(V) Male birds = ZZ,
Female heterogamety= b Male heterogamety = a, Male homogamety = c
Which of the following combination is correct?
(A) I, III, IV II V
(B) II, IV I III
(C) III, IV II I
(D) II, IV I II

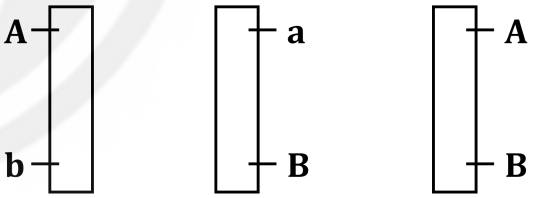
Q20 A woman receives her X chromosomes from:
(A) Her mother only
(B) Her father only
(C) Both her mother and father
(D) Mitochondria of mother only

Q21 Assertion: In birds, females produce two different types of gametes with respect to sex chromosomes.
Reason: Females possess dissimilar sex chromosomes unlike males. Choose the correct option.
(A) Both A and R are true and R explains A
(B) Both A and R are true but R does not explain A
(C) A is true but R is false
(D) A is false but R is true

Q22 In honey bees, females are (i) having (ii) chromosomes and males are (iii) having (iv) chromosomes.
(A) (i) (ii) (iii) (iv)Diploid 46 Haploid 23
(B) Haploid 23 Diploid 46
(C) Diploid 32 Haploid 16
(D) Haploid 16 Diploid 32

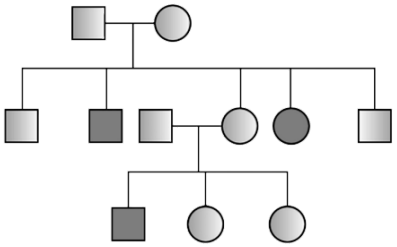
Q23 In Morgan's experiment, recombination frequency between white and yellow genes was 1.3%, while between white and miniature genes was 37.2%. This indicates that
(A) White and yellow genes are farther apart
(B) White and miniature are tightly linked
(C) White and yellow are closely linked
(D) Miniature and yellow are allelic

Q24 In the diploid cells of a flowering plant, alleles of two linked genes A and B are located as follows.
Out of 800 generative cells of the pollen grains formed by this plant, 50 has both dominant alleles A and B on the same chromosome as shown below
What should be the distance between those two genes in this plant ?



(A) 50 cM
(B) 25 cM
(C) 12.5 cM
(D) 6.25 cM

Q25 In this given pedigree what is the mode of inheritance



(A) Autosomal dominant
(B) Autosomal recessive
(C) X-linked dominant
(D) X-linked recessive

Q26 Which one of the following symbols and its representation, used in human pedigree analysis is correct?

(A) = Mating between relatives

(B) = Unaffected male

(C) = Unaffected female

(D) = Male affected

Q27 Which of the following statements are correct regarding pedigree analysis?
1. It helps to identify carriers of recessive disorders.
2. It distinguishes between autosomal and sex-linked inheritance.
3. It can detect exact gene mutations causing a disorder.

(A) 1 and 2 only (B) 2 only
(C) 1 and 3 only (D) All three

Q28 Which of the following statements are correct about Klinefelter's Syndrome?
A. This disorder was first described by Langdon Down (1866).
B. Such an individual has overall masculine development. However, the feminine development is also expressed.
C. The affected individual is short statured.
D. Physical, psychomotor and mental development is retarded.
E. Such individuals are sterile.
Choose the correct answer from the options given below:

(A) C and D only (B) B and E only
(C) A and E only (D) A and B only

Q29 Down's syndrome is caused by an extra copy of chromosome number 21. What percentage of offspring produced by an affected mother and a normal father would be affected by this disorder?

(A) 100% (B) 75%
(C) 50% (D) 25%

Q30 Identify the wrong statement with reference to the gene 'I' that controls ABO blood groups.
(A) The gene (I) has three alleles.
(B) A person will have only two of the three alleles.
(C) When I^A and I^B are present together, they express same type of sugar.
(D) Allele i does not produce any sugar.

Answer Key

Q1	C
Q2	C
Q3	C
Q4	C
Q5	C
Q6	B
Q7	B
Q8	A
Q9	A
Q10	B
Q11	C
Q12	C
Q13	A
Q14	A
Q15	B
Q16	C
Q17	B
Q18	D
Q19	A
Q20	C
Q21	A
Q22	C
Q23	C
Q24	D
Q25	B
Q26	A
Q27	A
Q28	B
Q29	C
Q30	C

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

Key Concept: Dominance

Explanation:

- Traits are controlled by discrete hereditary units present in pairs.
- In a heterozygous condition, only one factor expresses itself.
- The expressed factor is termed dominant.
- The unexpressed factor remains masked but is not lost.
- This leads to uniform appearance in first-generation offspring.

Video Solution:

Q2 Text Solution:

Key Concept: Segregation

Explanation:

- Each individual carries two factors for a trait.
- During gamete formation, these separate randomly.
- Only one factor enters each gamete.
- Fusion restores the pair in offspring.
- Hence masked traits reappear in later generations.

Video Solution:

Q3 Text Solution:

Key Concept: Genotypic ratio

Explanation:

- Gametes combine randomly during fertilisation.
- Equal probability exists for each allele combination.
- Homozygous dominant appears once.
- Heterozygous appears twice.
- Homozygous recessive appears once.

Video Solution:

Q4 Text Solution:

Key Concept: Allelic forms

Explanation:

- A character is governed by a pair of hereditary units.
- These units can exist in different forms.
- Each form influences expression differently.
- They occupy the same position on homologous structures.
- Such variants are termed alleles.

Video Solution:

Q5 Text Solution:

Key Concept: Incomplete dominance

Explanation:

- Neither allele completely masks the the other.
- Both contribute partially to phenotype.
- Resulting phenotype is intermediate.
- Genotypic and phenotypic ratios become identical.
- Seen in certain floral colour patterns.

Video Solution:

Q6 Text Solution:

Key Concept: Co-expression

Explanation:

- Both alleles remain active in heterozygote.
- Each produces its own product.
- Phenotype shows both traits simultaneously.
- No masking occurs.
- Leads to distinct combined expression.

Video Solution:

Q7 Text Solution:

Key Concept: Test cross

Explanation:

- Dominant phenotype may hide genotype.
- Crossing with recessive reveals hidden allele.
- Homozygous produces uniform offspring.
- Heterozygous produces mixed offspring.
- Thus genotype can be inferred.

Video Solution:

Q8 Text Solution:

Key Concept: Genetic terms

Explanation:

- Homozygous means identical pair.
- Heterozygous means dissimilar pair.
- Alleles are variant forms of same unit.
- Genotype refers to genetic makeup.
- These define inheritance patterns.

Q9 Text Solution:

Key Concept: Non-blending

Explanation:

- Traits remain discrete units.
- No mixing occurs between them.
- Hidden traits reappear later.
- Shows independent inheritance.
- Confirms particulate nature.

Video Solution:

Q10 Text Solution:

Key Concept: Multiple alleles

Explanation:

- More than two alleles exist in population.
- Individuals still carry only two alleles.
- Various combinations possible.
- Some combinations produce same phenotype.
- Hence fewer phenotypes than genotypes.

Video Solution:

Q11 Text Solution:

Key Concept: Loss of function

Explanation:

- Altered allele may fail to produce enzyme.
- No biochemical conversion occurs.
- Trait remains unexpressed.
- Functional allele masks defect.
- Leads to recessive expression.

Video Solution:

Q12 Text Solution:

Key Concept: Chromosomal imbalance

Explanation:

1. Non-separation during cell division causes imbalance.
2. Results in extra or missing chromosomes.
3. Alters gene dosage significantly.
4. Leads to developmental abnormalities.
5. Common in certain genetic syndromes.

Video Solution:

Q13 Text Solution:

Key Concept: Disorder mapping

Explanation:

1. Colour blindness involves X-linked gene defect.
2. Phenylketonuria results from enzyme absence.
3. Sickle cell involves amino acid substitution.
4. Thalassemia affects globin synthesis rate.
5. Each disorder has distinct molecular basis.

Video Solution:

Q14 **Text Solution:**
Key Concept: Chromosomal variation
Explanation:

1. Down syndrome involves extra chromosome 21.
2. Klinefelter shows XXY composition.
3. Turner has single X chromosome.
4. Polyploidy involves entire genome duplication.
5. Each condition reflects chromosomal anomaly.

Video Solution:

Q15 **Text Solution:**
Key Concept: Clotting defect
Explanation:

1. Essential clotting factor is absent.
2. Blood fails to clot properly.
3. Even minor injuries cause prolonged bleeding.
4. Inherited via sex chromosome.
5. Mostly affects males.

Video Solution:

Q16 **Text Solution:**
Key Concept: Genome duplication
Explanation:

1. Entire chromosome sets increase.
2. Often seen in plants.
3. Results from cell division failure.
4. Leads to increased genetic material.
5. May provide evolutionary advantages.

Video Solution:

Q17 **Text Solution:**
Key Concept: Family tracing
Explanation:

1. Direct experimental crosses are not feasible in humans.
2. Family records provide inheritance information.
3. Tracks traits across generations.
4. Helps identify inheritance pattern.
5. Widely used in genetic counselling.

Video Solution:

Q18 **Text Solution:**

Sex is determined by chromosome number rather than type.

Males are haploid and females are diploid.

Unfertilised eggs give rise to males.

Fertilised eggs develop into females.

This system is characteristic of certain insects.

Video Solution:

Q19 **Text Solution:**

To categorize the given examples based on sex determination systems:

- **Human males (XY)**: Male heterogamety
- **Female hen (ZW)**: Female heterogamety
- **Male Drosophila (XY)**: Male heterogamety
- **Male grasshopper (XO)**: Male heterogamety
- **Male birds (ZZ)**: Male homogamety

Based on this:

- **a (Male heterogamety)**: I, III, IV
- **b (Female heterogamety)**: II
- **c (Male homogamety)**: V

Video Solution:

Q20 **Text Solution:**

C: Both her mother and father

- A woman inherits **X from both parents**.
- She gets one X from **mother**, one from **father**.
- This is unlike males, who get X from mother only.
- Father passes his only X to all daughters.
- Therefore, **both parents contribute**.

Video Solution:

Q21 **Text Solution:**

Bird females carry two different sex chromosomes.

Males carry identical sex chromosomes.

Thus, females form two kinds of gametes.

This determines the sex of offspring.

The reason directly accounts for the assertion.

Video Solution:

Q22 Text Solution:

C : Diploid 32 Haploid 16

- In honeybees, females (queen and workers) are diploid with 32 chromosomes.
- Males (drones) are haploid with 16 chromosomes.
- Males develop from unfertilized eggs via parthenogenesis.
- Females develop from fertilized eggs.
- This is known as the haplodiploidy system.

Video Solution:

Q23 Text Solution:

(C) White and yellow are closely linked

- 1.3% recombination = very tightly linked genes.
- 37.2% recombination = genes farther apart.
- Thus, white and yellow are close on the chromosome.
- Recombination frequency indicates gene distance.

Video Solution:

Q24 Text Solution:

D. 6.25 cM

1. **Recombination Frequency**: Genetic distance is measured in centiMorgans (cM), and it is calculated based on the proportion of recombinant gametes. Recombination frequency is given by:

$$\text{Recombination frequency}(\%) = \frac{\text{Number of recombinant gametes}}{\text{Total number of gametes}} \times 100$$

2. **Information from the Problem**:
   - Total generative cells (pollen grains): 800
   - Recombinant generative cells: 50 (pollen grains with both dominant alleles A and B on the same chromosome).
3. **Calculating Recombination Frequency**: Substitute into the formula:

$$\text{Recombination frequency} = \frac{50}{800} \times 100 = 6.25\%$$

4. **Genetic Distance**: Recombination frequency in percentage directly represents the genetic distance in centiMorgans:

$$\text{Distance between genes} = 6.25\,\text{cM}$$

Video Solution:

Q25 Text Solution:

B. Autosomal recessive

- In autosomal recessive inheritance, the disease-causing gene is located on one of the autosomes (non-sex chromosomes).
- A person must inherit two copies of the mutant allele (one from each parent) to express the disorder.
- Carriers (heterozygotes) have one mutant allele but are usually healthy.
- Such traits skip generations and often appear only when both parents are carriers.
- **Examples:** Phenylketonuria and sickle cell anaemia.

Video Solution:

Q26 Text Solution:

A

= Mating between relatives

Video Solution:

Q27 Text Solution:

A. 1 and 2 only

Pedigrees help in identifying carriers and tracking inheritance.

They show autosomal vs sex-linked patterns.

They cannot reveal specific gene mutations; molecular tools are needed

Video Solution:

Q28 Text Solution:

(B) B and E only

- Klinefelter's syndrome is caused by an extra X chromosome (XXY).
- Affected males have some female characteristics.
- They are sterile and may show mental impairment.
- It is not described by Langdon Down (he described Down syndrome).
- Hence, options B and E are correct.

Video Solution:

Q29 Text Solution:

50% of the offspring would be affected by Down's syndrome because the affected mother can pass on either one of her normal chromosomes 21 or the extra chromosome 21, resulting in a 50% chance of offspring inheriting the extra chromosome.

Video Solution:

Q30 Text Solution:

- The ABO blood group is determined by the presence or absence of two surface antigens (A and B) on RBCs.
- The gene I controls ABO blood types and has three alleles: I^A, I^B, and i.
- I^A and I^B alleles produce different sugars, while allele i produces no sugar.
- Humans, being diploid, have two alleles of the gene I.
- I^A and I^B are dominant over i, so I^A or I^B will express when paired with i.
- When I^A and I^B are both present, they exhibit co-dominance and both sugars are produced.
- Two natural antibodies can be found in the plasma of different people in response to these antigens.

Video Solution: