INDIAN SCHOOL AL WADI AL KABIR		
Class: X	**DEPARTMENT: SCIENCE 2025 -2026** **SUBJECT: BIOLOGY**	**Date: 28/10/2025**
Worksheet No: 5 With Answers	**Chapter: HEREDITY AND EVOLUTION**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

OBJECTIVE TYPE QUESTIONS

MULTIPLE CHOICE QUESTIONS

1. Which of the following is a recessive trait in pea plants?
A) Round seeds
B) Yellow seeds
C) Wrinkled seeds
D) Tall stem

2. In a cross between a homozygous tall pea plant (TT) and a homozygous dwarf plant (tt), what will be the phenotype of F_1 generation?
A) All dwarf
B) All tall
C) 50% tall, 50% dwarf
D) Mixed tall and dwarf

3. The 9:3:3:1 phenotypic ratio in F_2 generation is obtained when:
A) Monohybrid cross
B) Dihybrid cross
C) Back cross
D) Test cross

4. Sex of a human child is determined by:
A) The mother alone
B) The father alone
C) Both parents equally
D) Random environmental factors

5. The father of genetics is:
A) Aristotle

B) Khorana
C) Morgan
D) Mendel

ASSERTION-REASONING QUESTIONS

For the following questions, two statements are given-one labelled Assertion (A) and the other labelled Reason(R). Select the correct answer to these questions from the options (i) , (ii), (iii) and (iv)as given below:
(i)Both A and R are true and R is the correct explanation of the Assertion.
(ii)Both A and R are true but R is not the correct explanation of the Assertion.
(iii)A is true but R is false.
(iv)A is false but R is true.

1. Assertion: Traits are inherited independently.
Reason: Ribosomes are located in DNA.

2. Assertion: Sex determination in humans is genetical.
Reason: Sex chromosomes are the similar in all human ovum.

3. Assertion (A): Dominant traits always get expressed in offsprings.
Reason (R): Dominant alleles mask the effect of recessive alleles in the heterozygous condition.

4. Assertion: A geneticist crossed a pea plant having violet flowers with a pea plant with white flowers, he got all violet flowers in first generation.
Reason: White colour gene is not passed on to next generation.

5. A: A recessive trait may be inherited but not expressed.
R: The genotype is heterozygous, possessing one dominant allele and one recessive allele.

Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.

1. Define heredity.

2. What is a gene?

3. Distinguish between acquired traits and inherited traits with an example.

4. What do you mean by a recessive trait? Give an example.

5. How is equal genetic contribution of male and female parents ensured in the progeny?

Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words.

1. Explain Mendel's experiment on monohybrid cross using pea plants and state his conclusion.

2. A Mendelian experiment consisted of breeding pea plants VV, bearing violet flowers with pea plants vv, bearing white flowers. What will be the result in F1 and F2 progeny? What will be the percentage of white flowers in F2 generation?

3. What is independent assortment? How did Mendel show that traits are inherited independently?

4. With the help of an example, explain how traits get expressed.

5. All the variations in a species do not have equal chances of survival. Why?

Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.

1. "It is possible that a trait is inherited but may not be expressed." Explain this with the help of a suitable example. Also describe how dominant and recessive traits work in inheritance.

2. Explain Mendel's Laws of Inheritance with respect to pea plant experiments. Include Laws of Dominance, Segregation, and Independent Assortment.

3. How many pairs of chromosomes are present in human beings? Out of these how many are sex chromosomes? How many types of sex chromosomes are found in human beings? "The sex of a new born child is a matter of chance and none of the parents may be considered responsible for it". Draw a flow chart showing determination of sex of a new born to justify this statement.

4. How did Mendel's experiments show that different traits are inherited independently? Explain.

5. List two differences in tabular form between dominant trait and recessive traits.
What percentage/proportion of the plants in the F2 generation/progeny were round, in Mendel's cross between round and wrinkled pea plants?

Case-based/data -based questions

A student performed an experiment to study the inheritance pattern of genes. He crossed tall pea plants (T T) with short pea plants (tt) and obtained all tall plants in F1 generation.

Attempt either subpart A or B.

A. When F1 plants were self-pollinated, a total of 800 plants were produced. How many of these would be tall, medium height or short plant? Give the genotype of F2 generation.

OR

B. When F1 plants were cross-pollinated with plants having tt genes, a total of 800 plants were produced. How many of these would be tall, medium height or short plants? Give the genotype of F2 generation.

C. What will be the set of genes present in the F1 generation?

D. Give a reason why only tall plants are observed in F1 progeny.

PREVIOUS YEAR BOARD QUESTIONS

1. In snails individuals can begin life as male and depending on environmental conditions they can become female as they grow. This is because

A. male snails have dominant genetic makeup.

B. female snails have dominant genetic makeup.

C. expression of sex chromosomes can change in a snail's life time.

D. sex is not genetically determined in snails.

2. Assertion (A): Generally, the number of chromosomes in a cell and in a germ cell is not the same in species.

Reason (R): When two germ cells combine, they restore the normal number of chromosomes in a species.

3. A. In a family of four individuals, the father possessed long ears and the mother possessed short ears. If the parents had pure dominant and recessive traits respectively and F1 individual is married to an unrelated individual of the same genotype, then calculate the ratio of genetic makeup of F2 generation. Show a suitable cross. (2)

B. If father had short ears and the mother had long ears, and both the parents are homozygous for the allelic pair of genes, explain what effect it will have on the ratio of genetic makeup in F2 generation, if F1 individual is married to an unrelated individual of the same genotype. (1)

4. If pea plants with round and green seeds (RRyy) are crossed with pea plants having wrinkled and yellow seeds (rrYY), the seeds developed by the plants of F1 generation will be –

(A) 50% round and green (B) 75% wrinkled and green

(C) 100% round and yellow (D) 75% round and yellow

5**.** Assertion (A): A human child bears all the basic features of human beings.

Reason (R): It looks exactly like its parents, showing very little variations.

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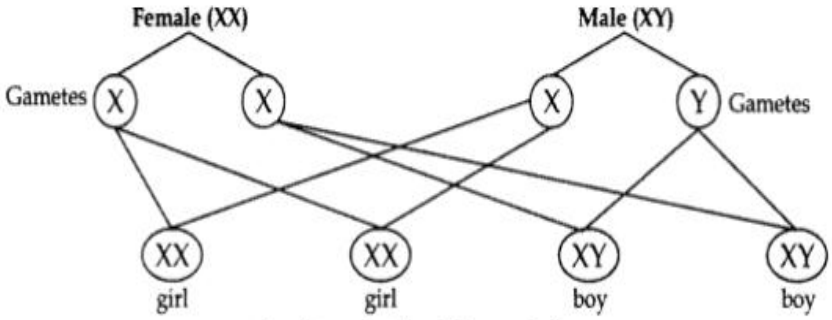
6. (a) What are chromosomes?

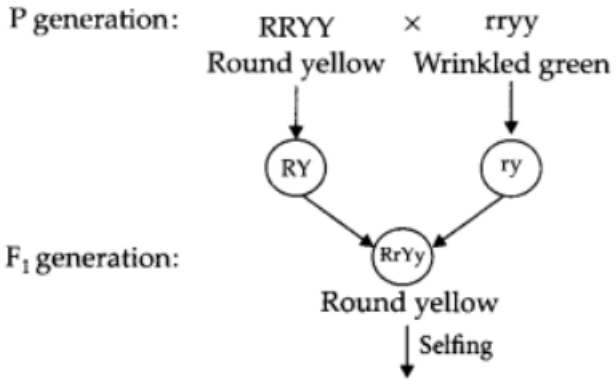
(b) Explain in brief how stability of DNA content of a species is ensured in sexually reproducing organisms?

ANSWERS FOR THE WORKSHEET QUESTIONS

	OBJECTIVE TYPE QUESTIONS MULTIPLE CHOICE QUESTIONS
1	C) Wrinkled seeds
2	B) All tall
3	B) Dihybrid cross
4	B) The father alone
5	B) The father alone
	ASSERTION-REASONING QUESTIONS
1	(iii)A is true but R is false.
2	(ii)Both A and R are true but R is not the correct explanation of the Assertion.
3	(i)A: True; R: True; R explains A
4	(iii)A is true but R is false.
5	(i)A: True; R: True; R explains A.
	Very Short questions carrying 02 marks each
1	Heredity is the process by which characteristics or traits are passed from parents to their offspring through genes. It explains why offspring resemble their parents in various features.
2	A gene is a unit of heredity, made up of DNA, located on chromosomes, which determines a specific trait (e.g. seed shape, flower colour) by coding for a particular protein.
3	Inherited traits are those passed genetically from parents (e.g. eye colour), whereas acquired traits arise due to environment or behaviour (e.g. calluses on hands). Acquired traits are not passed on to offspring.
4	A recessive trait is one that will be expressed only if an individual has two copies of the recessive allele (i.e. is homozygous recessive). For example, wrinkled seeds in pea plants.
5	During sexual reproduction a female gamete egg fuses with a male gamete sperm which are haploid to form a zygote. A zygote is diploid and contains 23 chromosomes from mother and 23 from father. In this way an equal genetic contribution of male and female parents is ensured in the progeny.
	Short Answer type questions carrying 03 marks each.
1	Mendel crossed pea plants that differed in one trait (e.g. tall vs dwarf). He found that F_1 generation all showed the dominant trait (tall). On self-pollination of the F_1, the F_2 generation showed both dominant and recessive in a ratio of 3:1. Conclusion: Traits are governed by pairs of alleles; one allele may mask the other; recessive traits reappear in F_2.

<table>
<tr><td>2</td><td>
Violet flowers VV x white flowers vv
<table>
<tr><td>gametes</td><td>V</td><td>V</td></tr>
<tr><td>v</td><td>Vv</td><td>Vv</td></tr>
<tr><td>v</td><td>Vv</td><td>Vv</td></tr>
</table>
All the F1 plants will be heterozygous violet flowered
F1 selfed to get F2
Violet flower Vv x Violet flower Vv
<table>
<tr><td>gametes</td><td>V</td><td>v</td></tr>
<tr><td>V</td><td>VV</td><td>Vv</td></tr>
<tr><td>v</td><td>Vv</td><td>vv</td></tr>
</table>
In F2 generation There will be:
Phenotype ratio - 3 Violet flowers: 1white flower
Percentage of white flowered plant is 25% (1/4)
</td></tr>
<tr><td>3</td><td>Independent assortment is the principle that different trait-pairs segregate independently during gamete formation. Mendel performed dihybrid crosses (e.g. seed shape and seed colour) and saw in F_2 generation a 9:3:3:1 ratio of combinations, confirming that seed shape and colour assorted independently.</td></tr>
<tr><td>4.</td><td>Gene is the segment of DNA which provides information for synthesis of a protein and this protein is responsible for a trait. For example: The height in plants.
Plant hormones control the height in plants. If the gene is dominant, more enzyme will be produced which in turn will help in increasing the hormone production. As a result, the plant will be tall. If the gene changes, protein(enzyme) is formed in less quantity, hormone will be less and in turn the plant will be short.
In this way, genes control traits in organisms.</td></tr>
<tr><td>5.</td><td>All the variations do not have equal chances of survival in the environment in which they live. Depending on the nature of variations, different individuals would have different kinds of advantages. The organisms which are most adapted to the environment will survive.
Depending on the nature of variations, different individuals would have different kinds of advantages. Bacteria that can withstand heat will survive better in a heat wave, as we have discussed earlier. Selection of variants by environmental factors forms the basis for evolutionary processes, as we will discuss in later sections.</td></tr>
<tr><td></td><td>Long Answer type questions carrying 05 marks each.</td></tr>
<tr><td>1.</td><td>Every individual has two alleles for each gene, one from each parent. A trait may be inherited (i.e. the allele present) but not expressed if it is recessive and paired with a dominant allele.
Example: In pea plants, height trait—tall (T) is dominant, dwarf (t) is recessive. A plant with genotype Tt inherits the dwarf allele, but doesn’t express dwarf because tall is dominant. Only if genotype is tt, will it express dwarf trait.
Dominant trait: allele that masks expression of recessive allele in heterozygote (e.g. T in Tt).</td></tr>
</table>

	Recessive trait: expressed only when both alleles are recessive (e.g. tt).
2.	Law of Dominance: When two different alleles of a gene are present, one (dominant) masks the other (recessive). In Mendel's monohybrid cross, all F_1 showed the dominant trait. Law of Segregation: During gamete formation, the two alleles of a gene separate so that each gamete carries only one allele. In F_2, the recessive trait reappeared in 1/4 of plants. Law of Independent Assortment: Genes for different traits assort independently during gamete formation; demonstrated by dihybrid crosses giving phenotypic ratio 9:3:3:1 in F_2.
3.	There are 23 pairs of chromosomes present in human beings. There is 1 pair of sex chromosomes present in human beings. The chromosomes which determine the sex of a person are called sex chromosomes. There are two types of sex chromosomes, one is called X chromosome and the other is called Y chromosome. Males contain one X chromosome and one Y chromosome (XY), while females contain two X chromosomes (XX). A male has one X-chromosome and one Y-chromosome. Thus, half the male gametes have X- chromosomes and the other half have Y-chromosomes. • A female has two X-chromosomes. Thus, all female gametes have only X-chromosomes. • If a sperm carrying Y-chromosome fertilises an ovum carrying X-chromosome, then the child born will be a boy. • If a sperm carrying X-chromosome fertilises an ovum carrying X-chromosome, then the child born will be a girl.  *Sex determination in human beings*
4.	In a dihybrid cross given by Mendel, it was observed that when two pairs of traits or characters were considered, each trait expressed independent of the other. Thus, Mendel was able to propose the Law of Independent Assortment which says about independent inheritance of traits. This could be explained clearly from the given cross:



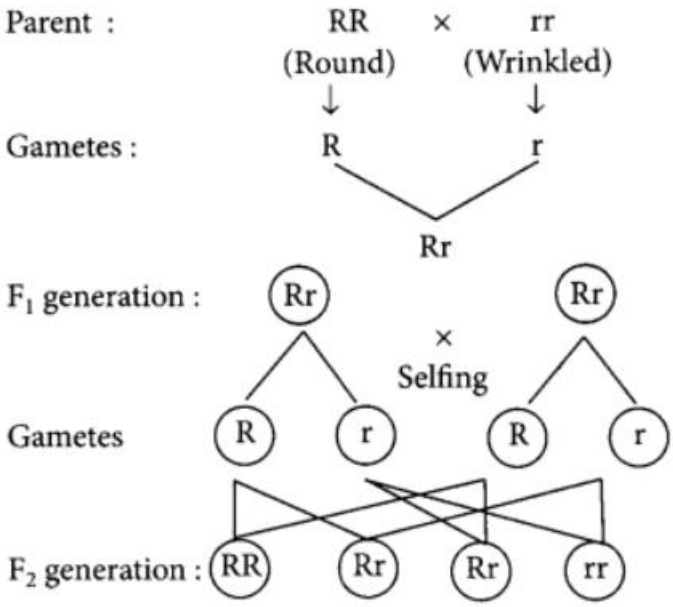
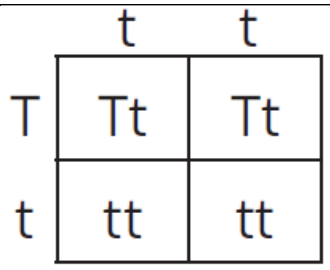
	RY	Ry	rY	ry
RY	RRYY Round yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	rrYy Wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy Wrinkled yellow	rryy Wrinkled green

F2 generation ratio : Round-yellow = 9 : Round- green = 3: Wrinkled-yellow = 3: Wrinkled-green = 1

5. Differences between dominant traits and recessive trait are given below:

Dominant trait	Recessive trait
(i) It is the trait controlled by dominant allele.	It is the trait controlled by recessive allele.
(ii) It is the trait which is expressed in F_1 generation.	It is the trait which remains suppressed in F_1 generation and appears in F_2 generation.

Out of total 4 genotypes possible in F_2 generation 31 genotypes result in phenotypic expression of round seeds. So, the percentage of plants with round seeds will be 75%. This can be illustrated as follows:

	
	Case-based/data -based questions
A	When F1 plants were self-pollinated, both tall and short traits are expressed in F2 generation in the ratio 3:1. Thus, 600 plants will be tall and 200 plants will be short. The genotype of F2 generation is TT : Tt : tt 1 : 2 : 1
B	 In this cross, 400 tall (Tt) and 400 short (tt) will be produced. The genotype of F2 generation is Tt : tt 1 : 1
C	Genes present in F1 generation is Tt.
D	It is so because tallness (T) is a dominant trait and short (t) is a recessive trait in pea plants.
	PREVIOUS YEAR BOARD QUESTIONS
1	D. sex is not genetically determined in snails.
2	A. Both A and R are true, and R is the correct explanation of A.
3	(Any letter which clearly indicated dominant and recessive ears, example, L or E or any other) A. LL × ll F1= Ll Ll X Ll 1LL:2Ll:1ll.

	(2) B. No change in ratio/the ratio of F2 generation will still be 1LL:2Ll:1ll/ ratio will be the same. As the cross is still between a pure dominant and recessive allele/ genes/ traits/characters /as shown in the cross above. (1)
4	(iii)A is true but R is false.
5	(a) Chromosomes are thread-like structures made of proteins and DNA found in the nucleus at the time of cell division. (b) In sexually reproducing organisms the gametes undergo meiosis and hence each gamete contains only half a set of chromosomes. When two gametes fuse the zygote formed contains the full set of chromosomes.

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