INDIAN SCHOOL AL WADI AL KABIR		
Class: X	**DEPARTMENT OF SCIENCE:2026-27** **SUBJECT: BIOLOGY**	**Date: 03/11/2026**
WORKSHEET NO:6 WITH ANSWERS	**TOPIC: HEREDITY**	**A4 FILE FORMAT (PORTFOLIO)**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

I. OBJECTIVE TYPE QUESTIONS (1 Mark):

1. When a tall pea plant is crossed with a short pea plant, all F_1 plants are tall. When these F_1 plants are self-pollinated, what fraction of the F_2 plants will be short?

(A) None of the plants

(B) One half of the plants

(C) One quarter of the plants

(D) Three quarters of the plants

2. In Mendel's cross, a tall plant (TT) was crossed with a short plant (tt). The ratio of TT : Tt : tt among the F_2 plants is:

(A) 3 : 1

(B) 1 : 2 : 1

(C) 1 : 1 : 2

(D) 2 : 1 : 1

3. A tall pea plant with round seeds is crossed with a short pea plant with wrinkled seeds. The progeny in the F_1 generation will be:

(A) all tall with round seeds

(B) all tall with wrinkled seeds

(C) half tall and half short, all with round seeds

(D) all of medium height with round seeds

4. Some amount of variation is produced even during asexual reproduction. It arises mainly due to:

(A) the combination of paternal and maternal DNA

(B) the fusion of two germ cells

(C) small inaccuracies in DNA copying

(D) the separation of chromosomes into two sets

5. The independent inheritance of two different traits is explained by the fact that each gene set is present:

(A) as separate independent pieces called chromosomes

(B) as a single long thread of DNA

(C) as one chromosome only in every cell

(D) only in the germ cells and not in the body cells

6. The germ cells of a sexually reproducing organism contain:

(A) both the chromosomes of every pair

(B) only the chromosomes inherited from the mother

(C) only the chromosomes inherited from the father

(D) one chromosome from each pair, which may be of maternal or paternal origin

7. A section of DNA that provides information for making one protein is called a:

(A) chromosome

(B) hormone

(C) gene

(D) zygote

8. In human males, the pair of sex chromosomes is mismatched because:

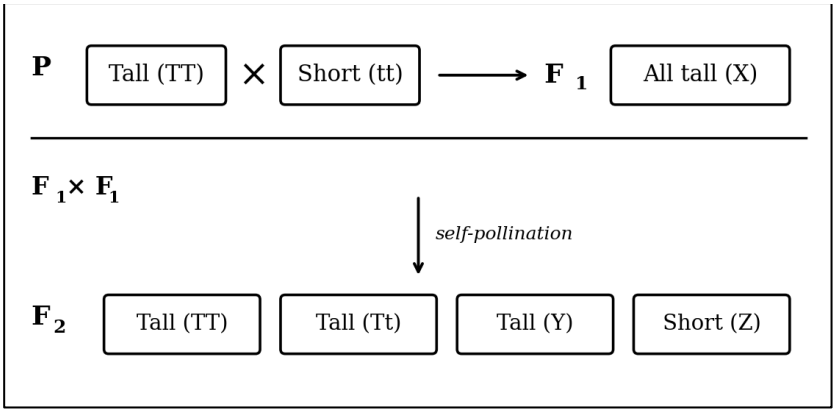
(A) both are Y chromosomes, one from each parent

(B) one is a normal-sized X while the other is a short Y

(C) both are X chromosomes of different sizes

(D) one is a normal-sized Y while the other is a short X

9. Study the cross shown in the diagram. The correct trait combinations for X, Y and Z are:



(A) X = Tt, Y = Tt, Z = tt

(B) X = TT, Y = Tt, Z = tt

(C) X = Tt, Y = tt, Z = Tt

(D) X = tt, Y = TT, Z = Tt

For the questions 10 to 14, 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 A.

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

(iii) A is true but R is false.

(iv) A is false but R is true.

10. **Assertion (A):** When a tall pea plant is crossed with a short pea plant, all the F_1 plants are tall.

Reason (R): The shortness trait is not inherited by the F_1 plants.

11. **Assertion (A):** The tall/short trait and the round/wrinkled seed trait are inherited independently in pea plants.

Reason (R): Each gene set is present not as a single long thread of DNA but as separate independent pieces called chromosomes.

12. **Assertion (A):** In snails, individuals can change sex.

Reason (R): In human beings, the sex of an individual is largely genetically determined.

13. **Assertion (A):** In human beings, the sex of a child is determined by the temperature at which the fertilised egg is kept.

Reason (R): In human beings, the genes inherited from the parents decide whether the child will be a boy or a girl.

14. **Assertion (A):** The sex of a child in human beings depends on what the child inherits from the father.

Reason (R): All children inherit an X chromosome from their mother, whether they are boys or girls.

II. SHORT ANSWER TYPE QUESTIONS (2 Marks):

15. Define dominant and recessive traits. Give an example of each from the tall/short pea plant cross.

16. How does the creation of variations in a species promote survival?

17. A child bears all the basic features of a human being, yet it does not look exactly like its parents. Give reason.

18. In Mendel's cross between a tall and a short pea plant, no medium-height plants were seen in the F_1 generation. Why were all the F_1 plants tall even though they also inherited the shortness trait?

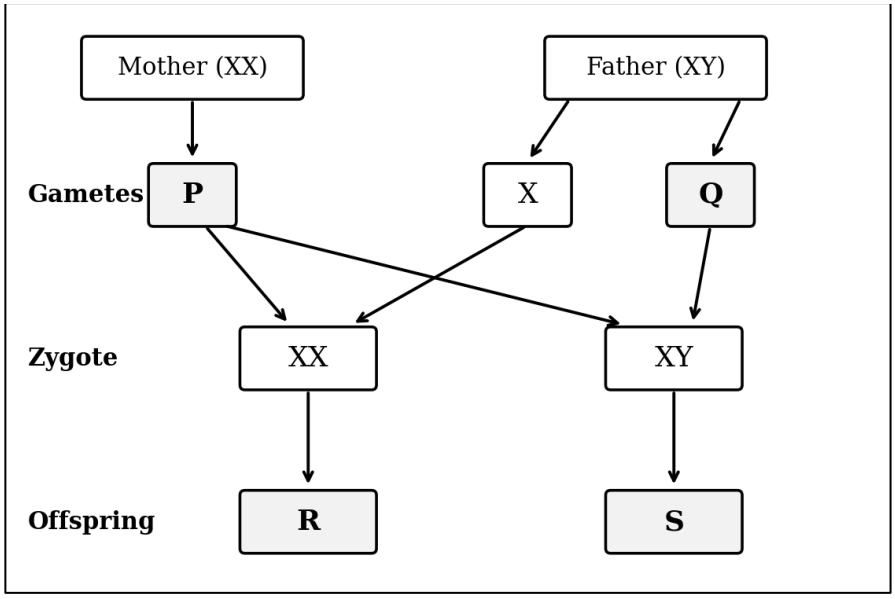
III. SHORT ANSWER TYPE QUESTIONS (3 Marks):

19. Describe Mendel's experiment in which he crossed a tall pea plant with a short pea plant. State the results in the F_1 and F_2 generations and the conclusion drawn.

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

21. Explain, with the help of an example, how genes control the traits of an organism.

22. The diagram shows how sex is determined in human beings.



(i) Identify the gamete P and the gamete Q.

(ii) Identify the offspring R and S.

(iii) Which parent determines the sex of the child? Give a reason.

23. Why would the independent inheritance of two traits not be possible if the progeny inherited a single whole gene set from each parent? How does the presence of chromosomes explain independent inheritance?

IV. LONG ANSWER TYPE QUESTIONS (5 Marks):

24. Pea plants with round, green seeds (RR yy) are crossed with pea plants having wrinkled, yellow seeds (rr YY). The F_1 plants are then self-pollinated to obtain the F_2 generation. The gametes formed by an F_1 plant are given as the rows and columns of the table below.

	RY	**Ry**	**rY**	**ry**
RY				
Ry				
rY				
ry				

(a) State the trait combination of the F_1 plants and describe their seeds.

(b) Complete the table to show the F_2 progeny.

(c) In an actual experiment, 556 F_2 seeds were obtained: 315 round, yellow; 108 round, green; 101 wrinkled, yellow; and 32 wrinkled, green. Write the approximate ratio of the four types of seeds.

(d) What do the results show about the inheritance of seed shape and seed colour?

25. Explain how variation accumulates over generations during reproduction. Compare asexual and sexual reproduction in this respect and explain why all the variations in a species do not have equal chances of survival.

V. CASE STUDY-BASED QUESTIONS (4 Marks):

26. In an experiment, a tall pea plant was crossed with a short pea plant and all the F_1 plants were tall. The F_1 plants were then self-pollinated and 1200 F_2 plants were obtained.

(i) Which trait is dominant: tallness or shortness?

(ii) Write the trait combination (using T and t) of the F_1 plants.

(iii) How many of the F_2 plants are expected to be short?

(iv) In what ratio will the TT, Tt and tt plants be present in the F_2 generation? How many TT plants are expected?

27. A couple has two daughters and is expecting a third child. A relative says that the mother is responsible if they have no son. A student explains that this idea is wrong.

(i) Which sex chromosome does a mother pass on to all her children?

(ii) What types of sex chromosomes are present in the father's sperm?

(iii) What will be the sex of a child who inherits a Y chromosome from the father?

(iv) Is the mother responsible for the sex of the child? Give a reason.

28. A student read that plant height depends on a plant hormone that triggers growth. The amount of hormone made depends on the efficiency of an enzyme needed for making it. The student studied two pea plants: plant P was tall and plant Q was short.

(i) Name the section of DNA that provides information for making the enzyme (a protein).

(ii) In plant Q, the enzyme is less efficient. What does this indicate about the gene for the enzyme in plant Q?

(iii) Why is plant Q short?

(iv) What does this example show about the relationship between genes and traits?

VI. PREVIOUS YEAR BOARD QUESTIONS:

29.The genotype of green stemmed tomato plant is denoted by 'GG' and that of purple stemmed tomato plant as 'gg'. Hybrid of a cross between these two were self-pollinated to obtain F_2 progeny. What will be the ratio of GG, Gg and gg in this F_2 progeny ? (CBSE -2025-26)

(A) 2: 1: 1

(B) 3: 1: 0

(C) 1: 1: 2

(D) 1: 2: 1

30. 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.

31. 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.

32. (a) Giving two examples, justify the statement that the sex of the offspring in all animals is not always genetically determined.

(b) Differentiate between the sex chromosomes of male and female human beings. (CBSE 2025-26)

33. 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)

34. 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

35. 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.

36. (a) What are chromosomes?

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

ANSWERS

I. OBJECTIVE TYPE QUESTIONS (1 MARK)	
1	(C) One quarter of the plants
2	(B) 1 : 2 : 1
3	(A) all tall with round seeds
4	(C) small inaccuracies in DNA copying
5	(A) as separate independent pieces called chromosomes
6	(D) one chromosome from each pair, which may be of maternal or paternal origin
7	(C) gene
8	(B) one is a normal-sized X while the other is a short Y
9	(A) X = Tt, Y = Tt, Z = tt
10	(iii) A is true but R is false. (Both the tallness and shortness traits were inherited in the F_1 plants, but only the tallness trait was expressed.)
11	(i) Both A and R are true, and R is the correct explanation of A.
12	(ii) Both A and R are true, but R is not the correct explanation of A.
13	(iv) A is false but R is true. (Temperature determines sex in a few reptiles, not in human beings.)
14	(i) Both A and R are true, and R is the correct explanation of A.

II. SHORT ANSWER TYPE QUESTIONS (2 MARKS)	
15	A trait like ‘T’, for which a single copy is enough to be expressed, is called a dominant trait; a trait like ‘t’, for which both copies must be ‘t’ to be expressed, is called a recessive trait. In pea plants, tallness (T) is dominant and shortness (t) is recessive.
16	Depending on the nature of the variations, different individuals have different kinds of advantages. For example, bacteria that can withstand heat will survive better in a heat wave. Thus, selection of variants by environmental factors helps the species to survive.
17	Inheritance from the previous generation provides a common basic body design, so the child has all the basic features of a human being. However, both parents contribute DNA, and subtle changes and newly created differences accumulate during reproduction, so the child is not exactly like its parents.

II. SHORT ANSWER TYPE QUESTIONS (2 MARKS)	
18	The F1 plants inherited both tallness (T) and shortness (t) traits. However, only tallness was expressed because T is dominant over t. A single copy of T is sufficient to make the plant tall. Therefore, all F1 plants were tall (Tt).

III. SHORT ANSWER TYPE QUESTIONS (3 MARKS)	
19	Mendel crossed a tall plant and a short plant. All the F_1 plants were tall; there were no 'medium-height' plants. When the F_1 tall plants were self-pollinated, the F_2 progeny were not all tall; one quarter of them were short (3 tall : 1 short). This indicated that both the tallness and shortness traits were inherited in the F_1 plants, but only the tallness trait was expressed. He proposed that two copies of a factor (now called genes) controlling a trait are present in a sexually reproducing organism.
20	Each cell of a sexually reproducing organism has two copies of each chromosome, one each from the male and the female parent. Every germ cell takes only one chromosome from each pair. When two germ cells combine, the normal number of chromosomes is restored in the progeny. Thus, the progeny receives half of its DNA from each parent, which also ensures the stability of the DNA of the species.
21	Cellular DNA is the information source for making proteins in the cell. A section of DNA that provides information for one protein is called the gene for that protein. For example, plant height depends on the amount of a plant hormone that triggers growth. The amount of hormone made depends on the efficiency of an enzyme. If the gene for the enzyme works efficiently, more hormone is made and the plant is tall. If the gene has an alteration that makes the enzyme less efficient, less hormone is made and the plant is short.
22	(i) P is an X chromosome (egg); Q is a Y chromosome (sperm). (ii) R is a girl (female); S is a boy (male). (iii) The father determines the sex of the child. All children inherit an X chromosome from the mother, so the sex depends on whether the child inherits an X (girl) or a Y (boy) chromosome from the father.
23	If the progeny inherited a single whole gene set from each parent, the two characteristics (for example, 'R' and 'y') would be linked to each other and could not be independently inherited. This is explained by the fact that each gene set is present as separate independent pieces, called chromosomes. Every germ cell takes one chromosome from each pair, of either maternal or paternal origin, so traits are inherited separately and give new combinations of traits in the offspring.

IV. LONG ANSWER TYPE QUESTIONS (5 MARKS)

24

(a) The F_1 plants are Rr Yy; all of them have round, yellow seeds, so round and yellow are the dominant traits.

(b) The completed table is shown below.

	RY	**Ry**	**rY**	**ry**
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

(c) 315 : 108 : 101 : 32 is approximately 9 : 3 : 3 : 1 (round, yellow : round, green : wrinkled, yellow : wrinkled, green).

(d) New combinations of traits (round, yellow and wrinkled, green, in addition to the parental types round, green and wrinkled, yellow) appear in the F_2 generation. This shows that seed shape and seed colour are inherited independently of each other.

25

Inheritance from the previous generation provides a common basic body design and subtle changes in it for the next generation. When this generation reproduces, the next generation has the differences inherited from the first generation as well as newly created differences, so diversity accumulates over succeeding generations (Fig. 8.1).

In asexual reproduction, a single individual reproduces. If one bacterium divides, and the two bacteria divide again, the four bacteria are very similar, with only minor differences due to small inaccuracies in DNA copying. In sexual reproduction, even greater diversity is generated.

All the variations do not have equal chances of surviving in their environment. Depending on the nature of the variations, different individuals have different advantages; for example, bacteria that can withstand heat survive better in a heat wave. Selection of variants by environmental factors forms the basis of evolutionary processes.

V. CASE STUDY-BASED QUESTIONS (4 MARKS)

26

(i) Tallness is the dominant trait, because only the tallness trait was expressed in the F_1 plants.

(ii) Tt.

(iii) One quarter of 1200, that is, 300 plants.

(iv) TT : Tt : tt = 1 : 2 : 1. The number of TT plants expected is 300 (Tt = 600 and tt = 300).

27

(i) The X chromosome.

(ii) Half of the sperms carry an X chromosome and the other half carry a Y chromosome.

(iii) The child will be a boy.

(iv) No. All children inherit an X chromosome from the mother, so the sex of the child is determined by the chromosome inherited from the father.

V. CASE STUDY-BASED QUESTIONS (4 MARKS)	
28	(i) Gene. (ii) The gene for the enzyme in plant Q has an alteration that makes the enzyme less efficient. (iii) Less enzyme efficiency means a smaller amount of hormone is made, so the plant is short. (iv) Genes control characteristics, or traits.

VI. PREVIOUS YEAR BOARD QUESTIONS	
29	D. 1:2:1
30	D. sex is not genetically determined in snails.
31	(i) Both A and R are true, and R is the correct explanation of A.
32	(a) The sex of offspring is not always genetically determined because different animals use different strategies for sex determination. 1. Reptiles: In some reptiles, the temperature at which fertilised eggs are kept determines whether the developing offspring will be male or female. 2. Snails: In some snails, individuals can change their sex, indicating that sex is not genetically determined. **Male** / **Female** Have two different sex chromosomes, X and Y. / Have two identical sex chromosomes, both X. Chromosomal combination is XY. / Chromosomal combination is XX. One chromosome is a normal-sized X, while the other is a short Y chromosome. / Both chromosomes are normal-sized X chromosomes.
33	A. Let L = long ears (dominant) and l = short ears (recessive). Parents: LL × ll. Gametes: L and l. F_1: all Ll (long ears). $F_1 \times F_1$: Ll × Ll. Gametes: L, l and L, l. F_2: LL, Ll, Ll, ll. Ratio of genetic makeup of F_2 = 1 LL : 2 Ll : 1 ll. (2) B. There will be no change in the ratio. The cross is still between a pure dominant and a pure recessive parent, so the F_2 ratio will still be 1 LL : 2 Ll : 1 ll. (1)
34	(C) 100% round and yellow. (All the F_1 plants are Rr Yy; round and yellow are the dominant traits.)
35	(iii) A is true but R is false. (A child bears all the basic features of a human being but does not look exactly like its parents; human populations show a great deal of variation.)

VI. PREVIOUS YEAR BOARD QUESTIONS	
36	(a) Each gene set is present not as a single long thread of DNA, but as separate independent pieces, each called a chromosome. (b) Each cell has two copies of each chromosome, one each from the male and female parents. Every germ cell takes one chromosome from each pair. When two germ cells combine, they restore the normal number of chromosomes in the progeny, which ensures the stability of the DNA of the species.

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