1 | Traits and reproduction

REPRODUCTION & GENETICS | Student review

Name: _____ Class: _____ Date: _____

Work independently. Use the reminders and evidence in this packet. Label drawings, show probability work, and use specific evidence in explanations.

1. Match each term to its definition. Write the letter beside the term.

1. Gene ____	A. A version of a gene
2. Allele ____	B. Joining of sperm and egg
3. Chromosome ____	C. A change in a DNA sequence
4. Trait ____	D. A characteristic of an organism
5. Mutation ____	E. A section of DNA with instructions for a functional product
6. Fertilization ____	F. A DNA-containing structure that carries many genes

2. Fill in the blanks.

The cell parts inside the nucleus that contain genetic information are called _____. They are made of _____. A section of DNA that produces one protein or trait is called a _____.

3. Classify each example: S = sexual reproduction; A = asexual reproduction.

a. ____ A strawberry runner grows into a new plant.
b. ____ Sperm and egg unite to form a fish embryo.
c. ____ A hydra grows a bud that separates into a new hydra.
d. ____ Fertilization in a flower leads to a seed.

4. Complete the comparison. Assume no new mutations occur.

Feature	Sexual reproduction	Asexual reproduction
Sperm and egg join?		
Usually one or two parents?		
Offspring genetically identical to parent or new combinations?		

Quick check: A typical human body cell has ___ copies of each chromosome in an autosomal pair and ___ copies of most genes. Humans have roughly 20,000 protein-coding genes. Circle the range that includes this count: 100-1,000 / 10,000-50,000 / 500,000 or more.

2 | Predicting inheritance

REPRODUCTION & GENETICS | Student review

Reminder: In a simple dominant/recessive model, BB and Bb show the dominant trait; bb shows the recessive trait. Dominant does not mean stronger or more common. Each parent passes on one allele for this gene.

Worked example: In a fictional beetle, B = dark shell and b = pale shell.
A Bb parent crossed with a bb parent produces these possibilities:

	B	b
b	Bb	bb
b	Bb	bb

Two of four boxes are Bb: 50% dark. Two are bb: 50% pale. Each box is an equally likely possibility, not a guaranteed child.

5. Your turn. Cross two Bb beetles. Fill in the parent alleles and all four boxes.

	_____	_____
_____		
_____		

a. Probability of BB: _____ Bb: _____ bb: _____
b. Probability of a dark shell: _____ Pale shell: _____
c. Expected ratio of dark to pale offspring: _____

6. A student says, “These parents will have exactly one pale beetle in every group of four offspring.” Explain what the Punnett square actually predicts.

7. In a fictional mammal, nn causes an inherited condition; NN and Nn do not. Two parents without the condition are both carriers (Nn). List the possible offspring genotypes and explain the chance of the condition.

8. Circle the best answer. Mendel counted 602 purple-flowered and 198 white-flowered offspring. Which statement best explains these results?
A. The ratio is about 1:1; both traits occur equally often.
B. The ratio is about 3:1; counting many offspring helps reveal a pattern.
C. The ratio is about 3:1; every four offspring must include one white flower.
D. The ratio is about 1:3; white flowers are more common.

3 | Variation, environment, and mutations

REPRODUCTION & GENETICS | Student review

Reminder: A typical human body cell has 23 pairs of chromosomes. For most genes, it has two copies, one inherited from each parent. Eggs and sperm carry one chromosome from each pair. Sexual reproduction produces new allele combinations.

9. Two siblings have the same biological parents. Explain why they can inherit different combinations of alleles. Identical twins occur when one fertilized egg cell divides and the resulting early embryo separates and grows into two organisms. Explain why these twins begin with essentially the same genetic information.

10. Genes or environment? Researchers grew two plant varieties. Each value is the average height of 20 plants after four weeks. Light, soil, and temperature were kept the same. These are invented practice data.

Plant variety	Low water	Adequate water
A	12 cm	24 cm
B	18 cm	30 cm

a. Give one comparison supporting an environmental influence and one supporting a genetic influence. Use numbers.

b. A student says, “Variety B must make a particular growth protein faster.” Is that directly shown by these data or an inference? What evidence would help test it?

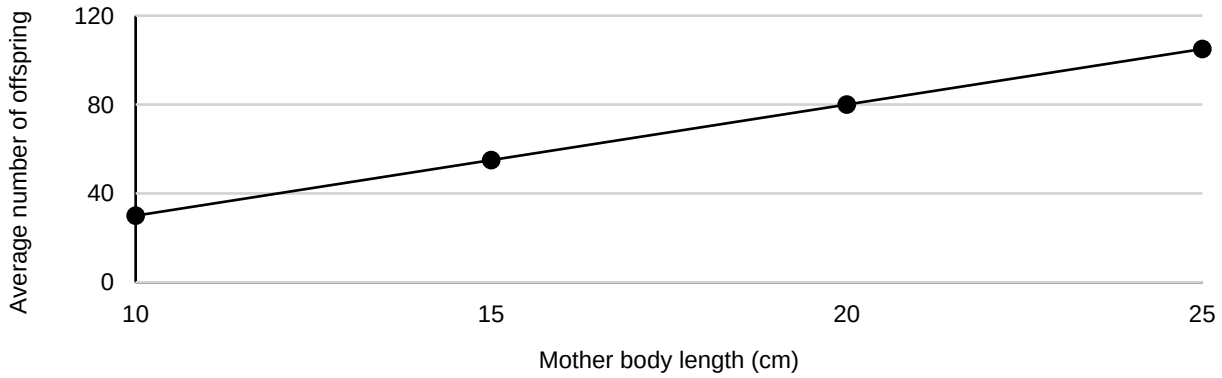
Model reminder: Some mutations change an amino acid in a protein. In a simplified model, opposite charges (+ and -) attract; like charges repel. A change can alter folding and function. Other mutations have no noticeable effect.

11. Draw a 2D cause-and-effect model. A mutation changes a + amino acid to a - near another - amino acid. Show the original attraction and changed interaction. Use arrows and a caption to connect DNA change, protein shape, protein job, and an organism's trait. Invent a simple protein job and label this as a simplified model.

Draw and write your caption here.

4 | Evidence for reproductive success

12. Read the graph. These invented practice data show averages for groups of female fish. Each group was observed under similar conditions.



a. Fill in the blanks: As mother body length increases, the average number of offspring _____. Mothers that are 10 cm long average _____ offspring; mothers that are 25 cm long average _____ offspring.

b. Propose a possible cause. Explain why the graph alone cannot establish that cause.

13. Plan an investigation. Male birds of a fictional species perform courtship dances. What comparison and measurements would help test whether dancing increases reproductive success? Identify one other factor to keep similar or record.

14. Match structure to function. A flower has a deep nectar tube, a strong nighttime scent, and pale petals. Candidate animals: a night-flying moth with a long feeding tube; a day-active beetle with short mouthparts; a wind-carried pollen grain. Choose the best candidate pollinator and explain using two flower features.

15. Correct the claim: “All mutations are harmful, and genes alone determine every trait.” Rewrite it accurately.