



**CREST**  
*Olympiads*  
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# CREST Science Olympiad (CSO) Worksheet *for*

**Class 10**



**Topic**

**Hereditary and Evolution**



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## Worksheet on Hereditary and Evolution

- In a population of fruit flies, a recessive allele (s) determines susceptibility to a fungal infection, while the dominant allele (S) confers resistance. If two heterozygous fruit flies (Ss) mate, what is the expected phenotypic ratio of their offspring with regard to susceptibility to the fungal infection?**
  - 1 susceptible: 3 resistant
  - 3 susceptible: 1 resistant
  - 2 susceptible: 2 resistant
  - All offspring will be resistant
- In a genetic experiment, you are studying the inheritance of blood groups in a family. The father has blood type A (genotype: IAIA), and the mother has blood type B (genotype: IBIB). What are the possible blood types of their offspring?**
  - Type A and Type B
  - Type AB only
  - Type O only
  - Type A, Type B, and Type AB
- Imagine you are conducting an experiment on the evolution of antibiotic resistance in bacteria. You expose a population of bacteria to antibiotics for several generations and observe changes in their resistance levels. Which principle of evolution does this experiment illustrate?**
  - Natural selection
  - Genetic drift
  - Speciation
  - Acquired traits
- In a population of cats, the presence of a certain fur pattern is determined by a sex-linked recessive gene located on the X chromosome. If all of the male offspring of a cat have the fur pattern and the females do not, what is the genotype of the parent female cat?**
  - XRXR
  - XRY
  - XRXr
  - XrXr
- Consider two species of mammals, one from a cold Arctic environment and the other from a hot desert environment. Both species have evolved the ability to conserve water in their bodies. What can you infer about the analogous structures responsible for water conservation in these species?**
  - The analogous structures in both species are the result of convergent evolution.
  - The analogous structures in both species are vestigial.
  - The analogous structures in both species are the result of divergent evolution.
  - The analogous structures in both species are identical in structure and function.

## Answer Key

1. b - In this scenario, the susceptibility to fungal infection is determined by a single gene with two alleles: S (dominant, conferring resistance) and s (recessive, determining susceptibility).

When two heterozygous fruit flies (Ss) mate, they each contribute one allele to their offspring.

	<b>S</b>	<b>s</b>
<b>S</b>	SS	Ss
<b>s</b>	Ss	ss

The possible allele combinations for their offspring are SS, Ss, Ss, and ss.

SS (homozygous dominant) individuals are resistant.

Ss (heterozygous) individuals are carriers of the resistance allele and are also resistant.

ss (homozygous recessive) individuals are susceptible.

Out of the four possible combinations, three results in susceptibility (Ss, Ss, and ss) and only one results in resistance (SS).

Therefore, the expected phenotypic ratio of their offspring with regard to susceptibility to the fungal infection is 3 susceptible (Ss, Ss, and ss) to 1 resistant (SS), which corresponds to option (b).

2. b - When a person with blood type A (genotype IAIA) has a child with a person with blood type B (genotype IBIB), each parent contributes one allele to their offspring. In this case:

The father can only contribute the IA allele (from genotype IAIA).

The mother can only contribute the IB allele (from genotype IBIB).

As a result, the child inherits both the IA and IB alleles (genotype IAIB), which correspond to blood type AB. Blood type AB is characterised by having both A and B antigens on the surface of red blood cells.

3. a - This experiment illustrates natural selection because it shows how a population of bacteria evolves over generations in response to the selective pressure of antibiotics. Bacteria with antibiotic-resistant traits have a survival advantage, leading to an increase in antibiotic resistance in the population.
4. c - In this scenario, the presence of the fur pattern is determined by a sex-linked recessive gene located on the X chromosome.

The dominant allele for the fur pattern is denoted as XR.

The recessive allele for the absence of the fur pattern is denoted as Xr.

Since all of the male offspring exhibit the fur pattern (males have only one X chromosome), they must inherit the Xr allele from their mother. This means that the female parent must carry one XR allele and one Xr allele (heterozygous) to pass on the Xr allele to all her male offspring while not displaying the fur pattern herself.

Therefore, the genotype of the female cat is XRXr.

5. a - Convergent evolution occurs when unrelated species, facing similar environmental pressures, independently evolve similar traits or structures to address those challenges. In this case, both species adapted to their respective extreme environments by developing analogous structures for water conservation, but these structures are not inherited from a common ancestor (homologous) nor vestigial (since they serve an important purpose in both species).

**More Questions Coming Soon – Keep Learning!**



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