Meiosis Poker

Objective

Meiosis Poker is a simple lab designed to reinforce a student's understanding of meiosis. This lab can be performed in one class period (30+ minutes) and only requires a deck of playing cards for each lab group.
Key Ideas:

1. Meiosis reduces the number of chromosomes in each cell.
2. Although each cell contains chromosomes which control the same genes, each one is genetically different.

This lab serves as a tactile, visual reminder of concepts that have previously been taught. It is recommended that students be allowed to access resource material during this lab. Students will be challenged to apply their knowledge of meiosis through increasingly difficult questions that require application and analysis.

Assessment

The blanks scattered throughout the lab demonstrate a students' knowledge of the steps of meiosis. The post-lab questions increase in difficulty and assess higher order thinking skills such as analysis, application, and evaluation.

Other Resources

A video demonstration of this lab is available free of charge on iTunes and YouTube.

Required Material:

- 1 Deck of playing cards per lab group
- Copy of lab for each student

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Meiosis Poker

Name: _____ *Hour:* _____

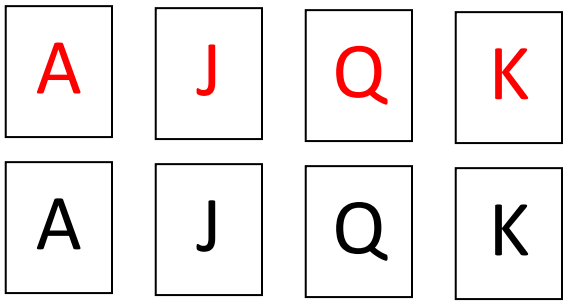
- Obtain one deck of playing cards.
- Group the cards by number (i.e. find all the 2's, all the jacks, etc.)
- Select four groups of cards to work with (i.e. Jack, King, Queen, Ace).
- Separate the cards by color

The red suites will represent chromosomes from the mother.
The black suites will represent chromosomes from the father.
The different suites (diamonds, hearts, etc.) represent genetic information passed on to the parents from the grandparents.

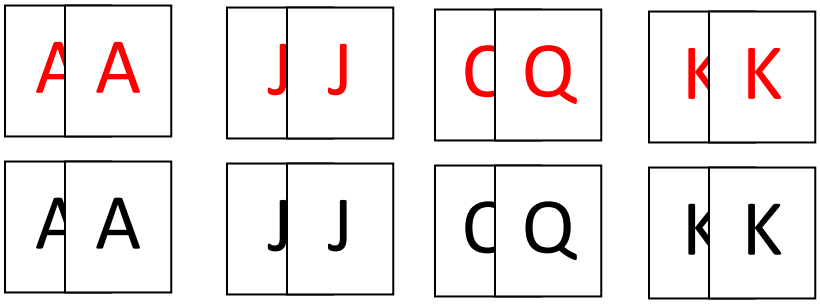
Please fill in all blanks before turning lab in. You may use external resources (textbook/worksheets) if needed.

Begin by selecting four red cards (all different) and four black cards (all different). Line them up in a parallel line. You should end up with four different numbers (four will be red and four will be black).

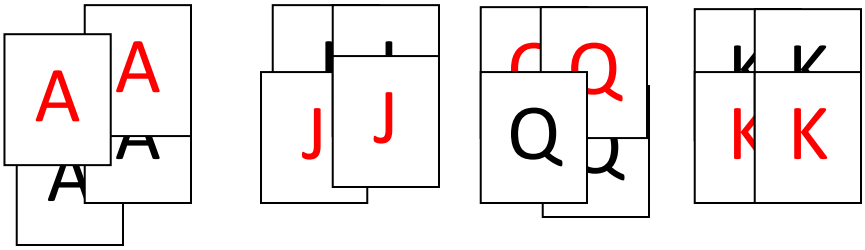
This is the G_1 phase of _____. Each card represents a _____ chromosome. This _____ (2n) cell has four pair of chromosomes. Every cell has two copies of each chromosome, one from each parent.



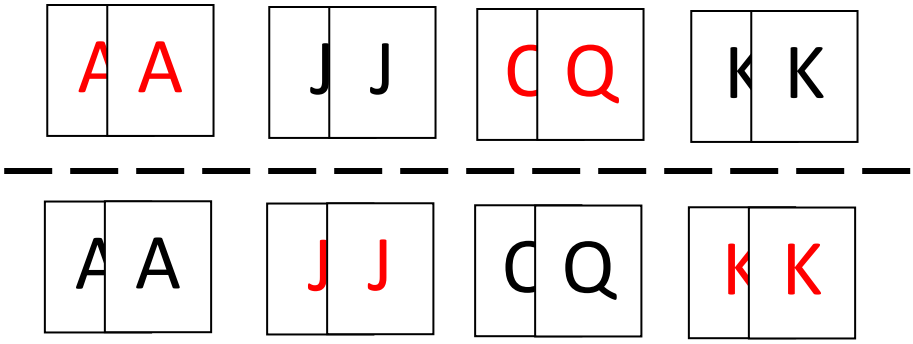
Add the additional red and black cards to their corresponding pair to simulate chromosome replication. **This is _____ of interphase I. Each group of two represents a _____ chromatid. After an additional period of growth, division begins.**



During _____ I of meiosis I, the homologous chromosomes and their sister chromatids are paired together into a _____ (group of four). Simulate this by combining all of the suites together. The chromosomes are packed very tightly together and _____ may occur at this time.



In _____ of meiosis the tetrads line up on the equator of the cell. The chromosomes are pulled apart in _____ I. Sister chromatids are still attached. Simulate anaphase I by separating the cards into two piles. Do this randomly so that you have some red suites and some black suites in each pile. **In meiosis, a cell membrane would form around these two groups of chromosomes, forming two *haploid* (1n) daughter cells.**



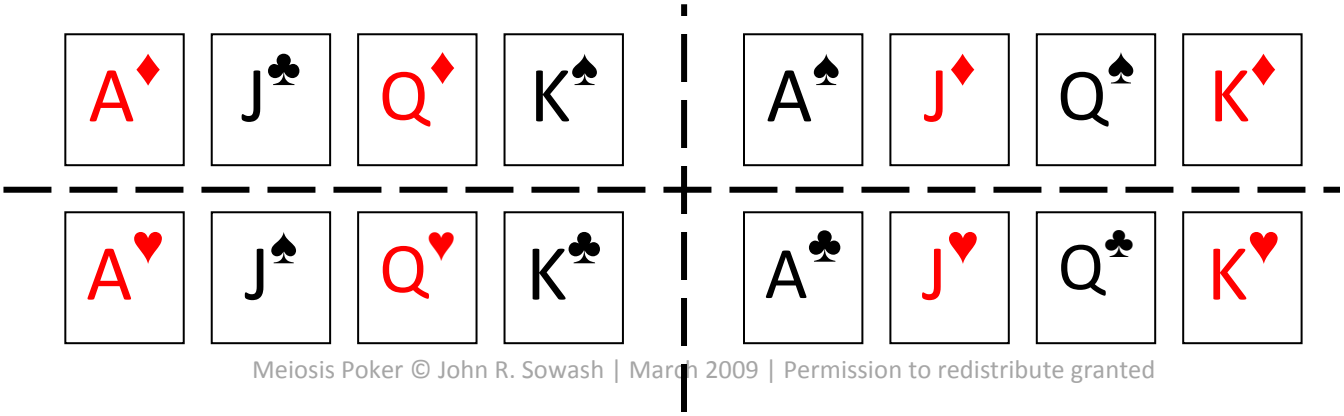
Meiosis II *(occurring in each of the new cells created above)*

_____ does NOT occur (no replication)

_____**II**: chromosomes are already paired with their duplicate.

_____ **II**: Chromosomes line up on equator (center) of cell.

_____ **II**: chromosomes are pulled apart. Simulate this by separating your cards into four piles. Note that although you have one of each kind of card, there is a random assortment color and suites. A cell membrane would appear around each of thesse cells during telophase/cytokinesis. Meiosis is now complete. Four _____ (1n) cells have been created from one diploid cell. These cells are called _____.



Post-lab questions

1. **What is the benefit of starting with two copies of each chromosome in interphase I?**

2. **Why isn't there an interphase II in meiosis?**

3. **What would happen if there was an interphase II of meiosis?**

4. **How does crossover increase genetic diversity in organisms?**

5. **In the playing card model of meiosis, how could crossover be illustrated?**

6. **What do you notice about the composition of your final groups of cards in anaphase II of meiosis?**

Meiosis Poker

Instructors Answer Key

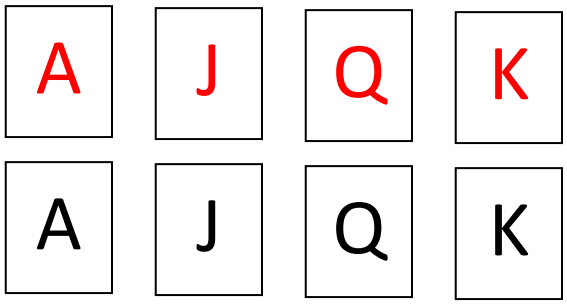
- Obtain one deck of playing cards.
- Group the cards by number (i.e. find all the 2's, all the jacks, etc.)
- Select four groups of cards to work with (i.e. Jack, King, Queen, Ace).
- Separate the cards by color

The red suites will represent chromosomes from the mother.
The black suites will represent chromosomes from the father.
The different suites (diamonds, hearts, etc.) represent genetic information passed on to the parents from the grandparents.

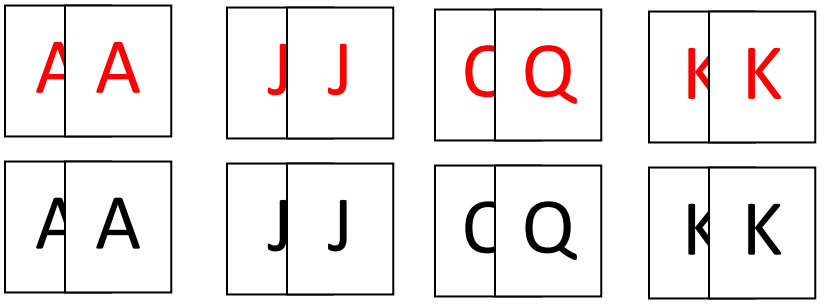
Please fill in all blanks before turning lab in. You may use external resources (textbook/worksheets) if needed.

Begin by selecting four red cards (all different) and four black cards (all different). Line them up in a parallel line. You should end up with four different numbers (four will be red and four will be black).

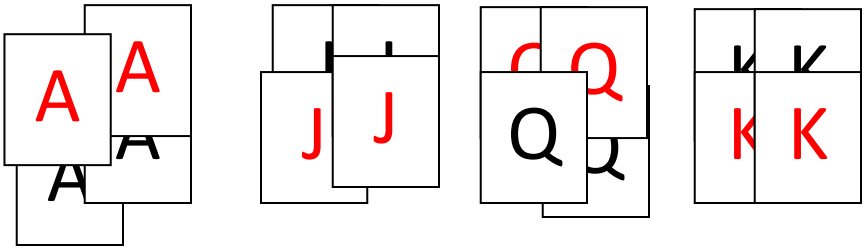
This is the G_1 phase of *interphase I.* Each card represents a *single* chromosome. This *diploid* (2n) cell has four pair of chromosomes. Every cell has two copies of each chromosome, one from each parent.



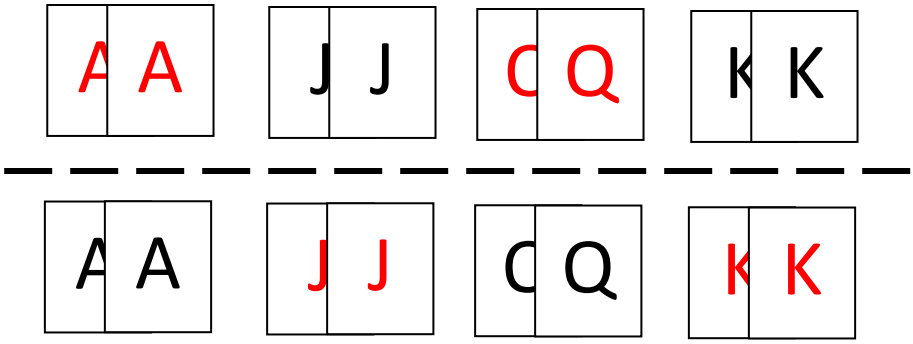
Add the additional red and black cards to their corresponding pair to simulate chromosome replication. **This is *synthesis* of interphase I. Each group of two represents a *sister* chromatid. After an additional period of growth, division begins.**



During ***prophase*** I of meiosis I, the homologous chromosomes and their sister chromatids are paired together into a ***tetrad*** (group of four). Simulate this by combiningg all of the suites together. The chromosomes are packed very tightly together and ***crossover*** may occur at this time.



In ***Metaphase I*** of meiosis the tetrads line up on the equator of the cell. The chromosomes are pulled apart in ***Anaphase*** I. Sister chromatids are still attached. Simulate anaphase I by separating the cards into two piles. Do this randomly so that you have some red suites and some black suites in each pile. **In meiosis, a cell membrane would form around these two groups of chromosomes, forming two *haploid* (1n) daughter cells.**



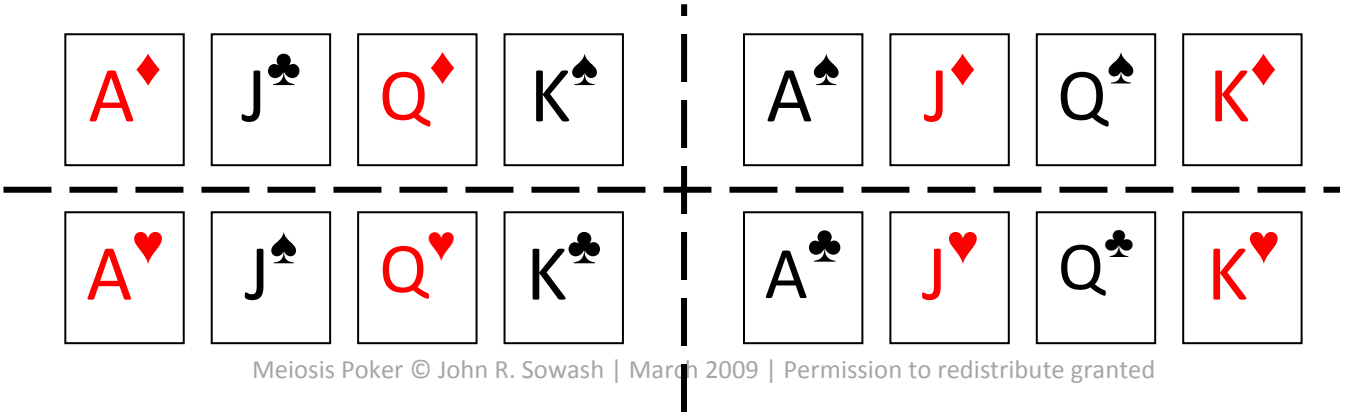
Meiosis II *(occurring in each of the new cells created above)*

Interphase does NOT occur (no replication)

Prophase **II**: chromosomes are already paired with their duplicate.

Metaphase **II**: Chromosomes line up on equator (center) of cell.

Anaphase **II**: chromosomes are pulled apart. Simulate this by separating your cards into four piles. Note that although you have one of each kind of card, there is a random assortment color and suites. A cell membrane would appear around each of thesse cells during telophase/cytokinesis. Meiosis is now complete. Four ***haploid*** (1n) cells have been created from one diploid cell. These cells are called ***gametes***.



Post-lab questions

7. **What is the benefit of starting with two copies of each chromosome in interphase I?**

    a. Having two copies reduces the chance of genetic defects occurring due to a corrupt chromosome. In essence, you have a backup in case one is defective.

    b. Having two copies of each chromosome also increases the genetic diversity of organisms. Since only one copy can be passed on to offspring, every gamete has a slightly different collection of chromosomes leading to diverse phenotypes and genotypes.

8. **Why isn't there an interphase II in meiosis?**

    a. The goal of meiosis is to reduce the number of chromosomes in a cell by half (1n or haploid). These specialized cells are called gametes or sex-cells. These cells are contain only ½ of the genetic information required for them to grow and divide. They must be combined with another gamete through sexual reproduction in order to become a diploid (2n) cell again.

9. **What would happen if there was an interphase II of meiosis?**

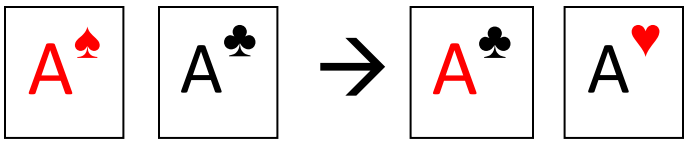
    a. The number of chromosomes in an organisms would double each time sexual reproduction occurred. An organisms with 8 pairs of chromosomes would produce offspring with 16 pair which would produce offspring with 32 pair, etc.

10. **How does crossover increase genetic diversity in organisms?**

    a. Crossover is the precise exchange of DNA between sister chromatids. When this occurs, a bit of maternal DNA is swapped with a bit of paternal DNA. None of the DNA is lost or destroyed, it's just recombined in a new way.

11. **In the playing card model of meiosis, how could crossover be illustrated?**

    a. Crossover would be like the suite symbols swapping places. For example, perhaps the club symbol and the heart symbol on aces could swap places.



12. **What do you notice about the composition of your final groups of cards in anaphase II of meiosis?**

    a. Each group should have a unique arrangement of suites (hearts, clubs, etc.) and colors while still having one of each type (K, Q, J, A) of card. This simulates the genetic diversity that is created through meiosis.