The following two diagrams show DNA transposable elements that are not functional due to a deletion of DNA. *Below each diagram indicate why they are not able to move*.

The deletion in the DNA removes part of the transposase gene. This element cannot move on it's own because it cannot produce the transposase protein that is required to cut out and move the sequence.

The deletion in the DNA removes one of the terminal inverted repeats. This element cannot move without both intact because both are required for the transposase to cut and move the sequence.

a. In the space below, state whether the two elements pictured above would become mobile in the presence of an autonomous DNA transposable element? *Justify your answer*. (5 points)

An autonomous element can only provide the transposase protein. It cannot donate its own terminal inverted repeat sequences to a non-autonomous element. Thus, only the first element would become mobile in the presence of an autonomous element.

A species of toad has a diploid chromosome number of 26. How many chromosomes would be found in each cell in each of the following mutant forms of the toad? (10 pts)

i. Nullisomic **24, missing 2 homologous chromosomes**

ii. Haploid **13, one complete set of chromosomes**

iii. Double Monosomic **24, missing 1 of two different homologous chromosomes**

iv. Double Trisomic **28, has 2 extra chromosomes. 1 each of two different chromosomes**

v. Triploid **39, three complete sets of chromosomes.**

A 3 year-old child exhibited some early indication of turner syndrome which results from the presence of only one X chromosome (XO). Cells isolated form the child confirmed this diagnosis.

b. If both of the parents have a normal karyotype, what genetic mechanism is responsible for their child being X0? Briefly explain which parent may be responsible. (5 points)

Either parent. Non disjunction could have occurred in either the father or the mother to produce a gamete without a sex chromosome.

c. Upon closer examination of the cells isolated from the child it was determined that some of these cells were X0 and some were XX. What mechanism would explain this finding? (5 points)

The XX cell was produced by non-disjunction during mitosis. The single X chromosome failed to separate during mitotic division giving rise to a daughter cell with two X chromosomes.

Answer the following questions.

1. You are doing complementation studies with several rII mutants you have isolated from the phage T4. To determine what mutations are alleles of one another, you co-infect *E.coli strain K* with pair-wise combinations of your mutants. Your initial complementation crosses yield the following results:

Mutant Crosses	Results (+ = lysis, - = no lysis)
1 x 2	+
1 x 3	+
1 x 4	-
1 x 5	-

In the following table, predict the results for the following crosses:

Mutant Crosses	Results (+ = lysis, - = no lysis)
4 x 5	**-**
2 x 4	**+**
3 x 5	**+**

You decide to determine the recombination frequency between rII mutants 4 and 5 from the previous problem. You co-infect *E.coli strain B* with mutants 4 and 5 and plate equal amounts of the resulting progeny on either *E.coli strain K* or *E.coli strain B*. The results are listed below:

Bacterial Host	# of Plaques
E.coli strain B	200,000
E.coli strain K	50

What is the recombination frequency between the 2 mutants?

RF= 2(50)/200,000= .0005 * 100% = 0.05 %

Since the phage that appear on the strain K plate are only the wildtype recombinants, you must multiply the number by 2 to account for the double mutant recombinants that do not appear.