Toothpick fish-exploring patterns in inheritance

What you need:
A range of toothpick colours (These can be purchased in Dealz or any art and hobby shop

Task:

You are going to experiment with genes and exposure to their environment for a population of 'toothpick' fish. You will work in pairs and learn about the relationships between many different aspects of fish life: genes, traits, variation, survival and reproduction. The activity models the wat fish and other organisms live in nature.

Firstly, recall you knowledge of the following terms, use you textbook or the internet to recap the following terms:

Allele……..
Genes ……
Trait ……..
Dominant……
Recessive……
Homozygous……
Heterozygous……

Introduction

The coloured toothpicks represent three different forms of a gene (green, red and yellow) that controls the trait skin colour

The table below tells you which forms (alleles) of the gene are dominant, which genes are recessive and which are equal (co-dominant or incomplete dominant)

The green gene (G)	Dominant to all other colours
The red gene (g)	Recessive to green Equal (co-dominant) to yellow
The yellow gene (g)	Recessive to green Equal (co-dominant) to red
Note: In the co-dominant state e.g. when you have a red and yellow gene the fish will have orange skin. Both recessive traits result in an intermediate colour (phenotype)	

Remember: Each toothpick represents a gene not a fish

Task: Complete each task which follows and tick off each one as you complete it

1. ☐ Count your toothpicks to make sure you have 8 of each colour (green, red and yellow), a total of 24 toothpicks.
2. ☐ Figure out which gene combinations give rise to which fish colours and fill in the answers on the table below

Fish Colour	**Gene Combination**	**State the colour of toothpick 1 and toothpick 2**
Green	e.g. GG and ……	
Red		
Yellow		
Orange		

Based on the answers that you gave in the table above, answer the questions below. (You may use a Punnett Square if you wish.)

a. Can two red fish mate and have green offspring? Why or why not?

b. Can two orange fish mate and have red offspring? Why or why not?

c. Can two green fish mate and have red offspring? Why or why not?

3. Create 12 fish from all 24 toothpicks genes. This is called the first generation of fish. To do this, pull out genes(toothpicks) in pairs without looking and set them aside carefully so that they stay in pairs. Once you have drawn your twelve pairs (do not move the pairs), record the results on the table on the pages which follows in the first generation section.

Table A

	Genotype (Genetic makeup/corresponding letters				Phenotype (the physical appearance/colour of skin			
Offspring	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Example	*Gg*				*Green*			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

Count the numbers of each colour of fish offspring and record the number in the table below (Table B)

Table B

Environment	Generation	Number of Green	Number of Red	Number of Orange	Number of Yellow
There is lots of green seaweed growing everywhere	First				
	Second				
	Third				

The stream where the fish live is very green and lush with lots of vegetation and algae covering the stream bed and banks. The green fish are very well camouflaged from predators in this environment and the red and orange fish camouflage quite well also. However, none of the yellow fish survive or reproduce because predators can easily spot them in the green algae environment.

Why have all of the yellow fish died?

If you have any yellow fish (fish in which both toothpicks are yellow), set those toothpicks aside. These fish are now dead.

4.

- [ ] Put all the genes you have back in the gene pool (remember, you have set aside any yellow fish).
- [ ] Draw a second generation of fish, again without looking.
- [ ] Record your gene pairs and fish colour in table A under second generation.
- [ ] Total up the fish of each colour and record the numbers in the second generation row in Table B. Again remove all yellow fish.

5.

The well camouflaged fish live longer and therefore have more offspring, so their number are increasing.

- [ ] Put all toothpicks back into the gene pool
- [ ] Draw toothpicks to make the third generation of fish. Record your data in Table A and then write the total numbers of each colour in the third generation row of Table B.
- [ ] Now return survivors to the gene pool (be sure to set aside any genes from yellow offspring, toothpicks where both are yellow)

STOP HERE: DO NOT PROCEED TO STEP 7. DISCUSS AND ANSWER THE FOLLOWING THREE QUESTIONS WITH YOUR PARTNER AND THEN AS A CLASS GROUP.

a. Have all of the yellow genes disappeared?
b. Have the number of yellow genes been reduced?
c. Why?

d. Has the population size changed? In what way? Would you expect this to occur in the wild?

e. Apart from colour how does the population in the third generation compare to the population colour in the earlier generations?