Name:_____

Date:_____Prd:_____

Mold Growth On Different Building Materials

BACKGROUND

Read the following article about mold. Mold growth typically follows a sigmoid (S-shaped) pattern. It starts with exponential growth until reaching a critical point where the growth rate slows down and eventually approaches a limiting value. This pattern can be modeled using a logistic function.

In this activity, you will examine mold growth on different building materials through a logistic growth model. The data used in this activity measures mold growth under controlled conditions: a steady **relative humidity of 97% and a constant temperature of 22°C.** In the data, time (in weeks) is the independent variable, while the mold index is the dependent variable.

A description of the mold index is provided below to help you understand how mold growth is quantified. Your task is to use sliders to adjust the parameters of the logistic growth function—**c**, **b**, and **k**—in order to create a curve that closely matches the given data. After making your adjustments, you will answer questions about how these parameters affect the mold growth pattern.

Mold Index	Description
0	No growth
1	Small amounts of microscopic mold on surface, initial stages of local growth
2	Several microscopic local mold growth colonies on surface
3	Visual findings of mold on surface, less than 10% coverage or less than 50% microscopic coverage
4	Visual findings of mold on surface, 10%-50% visual coverage, or greater than 50% coverage
5	Plenty of mold growth on surface, greater than 50% visual coverage
6	Heavy and tight growth, coverage about 100%

Part A: Analyzing Mold Growth Patterns

1. Open the DESMOS activity and review the list of 10 different building materials provided.
2. Choose 4 building materials you want to study and open their folders.
3. Turn on the data and the logistic growth equation for each selected material.
4. Observe the data showing mold index (dependent variable) over time in weeks (independent variable).
5. Look at the curve for each material and answer:

   What does the curve look like? _____

   Is the mold growth steady or changing? _____

6. For each material you explore, observe the graph and record the approximate week when the mold growth begins to level off. This is when the curve starts to flatten, showing slower growth.

Building Material	Time When Growth Starts to Level Off (weeks)
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

Part B: Exploring Logistic Growth Using Desmos Sliders

logistic function is:

$$N(t) = \frac{c}{1 + Be^{-kt}}$$

$N(t)$: number of spores at time t
c: carrying capacity
k and B: constants
e = Euler's number (~2.718)

7. Use the sliders in Desmos to explore how each parameter changes the shape of the logistic growth curve.
   - You increase *c* (carrying capacity)
   - You change *k* (growth rate)
   - You adjust *B* (initial growth condition)

8. Use the scalar to approximate c, b, and k and write your function by filling out the table below:

Equation #	c	b	k	Function N(t)
1				$N_1(t)$ =
2				$N_2(t)$ =
3				$N_3(t)$ =
4				$N_4(t)$ =

Part C: Making Predictions

9. Choose a logistic model and make predictions for the following values. Show all your work by substituting each value into the function. Then, explain what each estimate means in the context of the problem.

   - $N_1(8)$:

   - $N_3(115)$:

   - $N_2(135)$:

Part D: Investigating Environmental Effects

10. Research how the following variables would affect the growth of mold and therefore affect the models you created?
    - *Temperature*
    - *Relative humidity*

(Optional)

Compare logistic vs. exponential growth functions. Is one more realistic than the other? Give examples to justify your opinion.