

Investigation Starch and amylase

Amylase is an enzyme that catalyses the hydrolysis of starch. Iodine and starch react to produce a dark blue-black colour so iodine may be used as an indicator to show the rate at which starch is broken down. A light probe can be used to monitor the change in optical density. Used in this way the probe acts as a colorimeter.

Materials

TI Graphing Calculator with DataMate program installed	100 or 50 cm ³ beaker
Lab Pro or CBL2 interface	2 x 100cm ³ measuring cylinder
Light probe	5cm ³ syringe
Black paper and scissors	Amylase solution (2%)
Lamp	Starch solution (2%)
	pH 7 buffer solution
	Iodine solution

Starting the DataMate Program and setting up

1. Use the following steps to start the DataMate program on your calculator:

TI—73, TI—82, and TI—83 Calculators:

Press **PRGM** then press the calculator key for the number that precedes DATAMATE. Press **ENTER**. An introductory screen will appear, followed by the main screen.

TI-83 Plus Calculators:

Press **APPS**, then press the calculator key for the number that precedes DATAMATE. Press **ENTER**. An introductory screen will appear, followed by the main screen.

2. Plug the Light Probe into channel **CH 1** on LabPro or CBL2 interface.
3. Arrange the light source so that it shines through the beaker and into the light probe. Use the black paper to shield the beaker from changes in ambient light level
4. Put 30 cm³ pH 7 buffer into the beaker. Add 20 cm³ starch solution and a few drops of iodine.

Setting your recording times

1. Start the DataMate program. Press **CLEAR** to reset the program. DataMate will detect the auto-ID sensor, set the data collection parameters, and display the current sensor reading.
2. Press **1**: **SETUP** and using the cursor buttons, **↑** or **↓**, select **MODE** press **ENTER**.
3. Select **2**: **TIME GRAPH** and the screen **TIME GRAPH SETTINGS** will appear.
4. The default settings are 180 samples every 0.05s experiment will collect light readings for 9 seconds. To change this select **2**: **CHANGE TIME SETTINGS**

5. Type in a time interval in seconds, press **ENTER**, then the number of samples press **ENTER**. The experimental length in seconds is then given this should be about 5 minutes (300s) for a trial run.
6. Press **1: OK** then and again press **1: OK** to return to the main screen.

Collecting data

1. Select **2: START** to begin data collection, a double beep from the interface will confirm you are recording. You may stop data collection at any time by pressing the **STO→** key
2. Wait about 10 seconds and add 5 cm³ amylase solution. A live graph will appear on the calculator screen.
3. After the data collection is complete the interface will beep again and an autoscaled graph of the data will appear.
4. A cursor will appear flashing on the y-axis. Use the **↑** or **↓** keys to examine the data points along the displayed curve of light vs. time. As you move the cursor right or left, the light (X) and temperature (Y) values of each data point are displayed below the graph. Move the cursor to the point when the amylase was added to the starch solution. Record that time. Move the cursor to find the highest light intensity and record that time. How long did it take for the amylase to digest the starch?
5. To return to the main screen press **ENTER**.

Recording data

1. To save the data use the **5: TOOLS** option, then **1: STORE LATEST RUN**.
2. To see the stored data select **6: QUIT** and press the **STAT** key. Select **1: Edit** your data should appear in **L1** (time) and **L2** (light intensity). You may now shut down the calculator and transfer the data to a computer for further processing in a program such as MS Excel using the TI Graph Link

Further investigations

Which is the most appropriate recording method and why?

What would happen if you repeated the experiment at a different temperature?

At a different pH?

With a different concentration of starch?

What if the amylase is boiled before use?

What would you use as a control for these experiments?