Biology with TI-Nspire™ and TI-Nspire™ Navigator™ – Day 1

Materials for Workshop Participant*

I can…	TI-Nspire™ Handheld (HH) Data Collection (DC) TI-Nspire™ Navigator™ (Nav)
Login to class.	HH
Open a transferred TI-Nspire™ document.	HH
Grab and drag an object.	HH
Locate specific keys on the TI-Nspire™ keypad.	HH
Move from page to page.	HH
Interact with text on a TI-Nspire™ CX handheld.	HH

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Student Login

TI PROFESSIONAL DEVELOPMENT

Objective

- Participants will learn how students log in to a TI-Nspire™ CX Navigator™ class.

TI-Nspire™ CX Navigator™ Features

- Logging in to the TI-Nspire™ CX Navigator™ System from a handheld

TI-Nspire™ Technology Skills:

- Logging in as a student

Tech Tips:

- Make sure the font size on your TI-Nspire™ handheld is set to Medium.

The TI-Nspire™ CX Navigator™ System uses both your computer and your students' handhelds. Your computer and your students' handhelds communicate through the TI-Nspire™ CX Navigator™ access point.

You do not have to begin a class and have students log into the TI-Nspire™ CX Navigator™ network to communicate with your students' handhelds. Without beginning a class, you can use the Transfer Tool to send or delete documents and/or operating systems on the students' handhelds. However, if you plan to use Quick Poll, Class Capture, Live Presenter, or place documents in the Portfolio during the TI-Nspire™ CX Navigator™ class session, then you must log in student handhelds to the TI-Nspire™ CX Navigator™ network.

1. On the teacher computer, within the TI-Nspire™ CX Navigator™ Teacher Software, press Begin Class.
2. Turn on the handheld that is connected to a wireless network adapter (or locked in the cradle). You will notice the following icons on the handheld in the upper right hand corner.

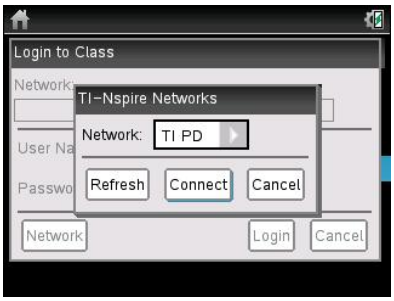
Icon	Status	Meaning
	Blinking	The handheld is searching for an access point.
	Solid with ✓	The handheld has found an access point.
	Solid with a warning sign	The handheld is not communicating with the wireless network adapter. Detach the handheld from the wireless adapter, wait for the icon to disappear, and then reattach the handheld to the adapter.
	Blinking	The handheld is connected to the network and is ready to log in.
	Solid	The handheld is logged in to the network and is fully charged.

Student Login

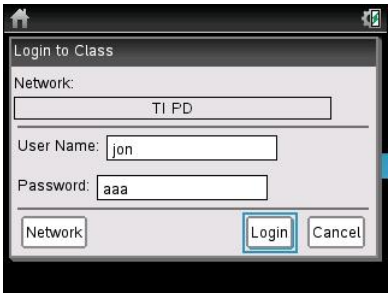
TI PROFESSIONAL DEVELOPMENT

3. When the  icon appears in the upper right-hand corner of the handheld, a “Login to Class” dialog box will appear.
    - If the dialog box does not appear, have students press [on] > **Settings > Login…**.

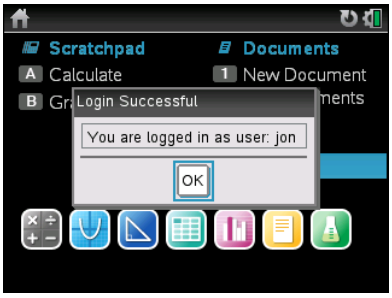
4. When logging in for the first time, a network must be selected. Click the **Network** button, select the appropriate network from the Network drop-down field, and click **Connect**.
    - A network only needs to be selected once, not every time a handheld is logged in.



5. Students will first enter their User Name, press [tab], and then enter their Password.
    - Passwords must be at least 3 characters. The teacher might have chosen the student password when setting up the class.



6. Press [enter], and the “Login Successful” dialog box will appear on the handheld.



TI-Nspire™ CX Family Overview

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will become familiar with the layout of the TI-Nspire™ CX family of handhelds.

Step 1:

Locate the Touchpad. The Touchpad is used to navigate the cursor around the screen. What appears in the center of the Touchpad?

Step 2:

Locate the keys to the left of the Touchpad. How do some of these keys compare in name and location to keys on a computer keyboard?

Step 3:

Note the light blue or yellow color of the commands that appear above many of the keys. Which key do you push to access the light blue or yellow options on the key pad?

Step 4:

Many of the traditional shortcut keys used with computer software are available on a TI-Nspire handheld. For example, ctrl C and ctrl V are used to "copy" and "paste," respectively.

Step 5:

Note the colors of various keys and the location of the alpha keys. What do you notice about the arrangement of the keys?

Step 6:

Where are the buttons for adding, subtracting, multiplying, and dividing located?

Step 7:

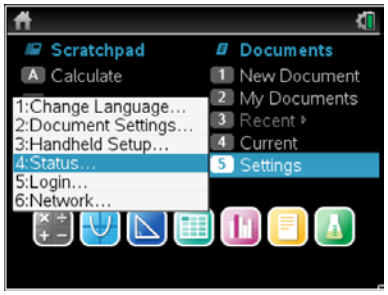
Press on to turn on the handheld. If the Home Screen is not displayed, press on again. Use the tab key to move to each of the Home Screen options. Note the applications available on the bottom row of the Home Screen.

Step 8:

Note the Scratchpad options available on the left hand side of the screen and the icon in front of the Scratchpad. Locate the Scratchpad key on the handheld.

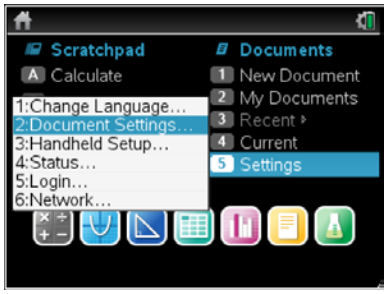
Step 9:

Select **Settings > Status** from the Home Screen. You will find the available memory and the battery status noted on the screen. Press esc or press ⚙ to choose OK to exit the Status screen.



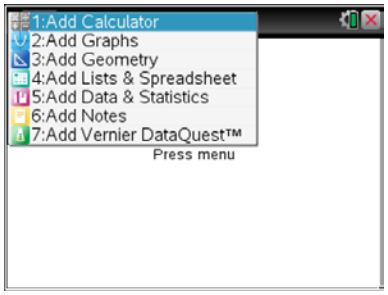
Step 10:

Select **Settings > Document Settings**. Explore the options available. Press esc or, using the Touchpad, move to OK and press ⚙ to exit the Document Settings menu.



Step 11:

From the Home Screen, select **New Document** to start a new document. If prompted to save the current document, select No. Choose **Add Calculator**. This Calculator page is the first page of the first problem in this new document. The tab indicating problem one, page 1 (1.1) is displayed in the top left corner of the screen.



Step 12:

Using the Touchpad, move the cursor to the icon to the left of the red **X** in the top right hand corner of the screen. What information is provided?

TI-Nspire™ CX Scavenger Hunt – The Calculator Application

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to perform basic calculations in the Calculator application. You will also be introduced to various features and commands.

1. Press [on] twice. There are three sections on the screen. In the bottom section, there are seven icons which represent seven different applications. Predict what these applications are:

   _____

2. What happens to the screen when you press and hold [ctrl] and then tap [−] several times? What happens when you tap [+] instead?

   _____

3. Open a New Document by using the Touchpad to move your cursor to New Document. Click by pressing [ ]. If the handheld asks you, "Do you want to save?" answer 'no.'
   How did you answer "no"? _____

4. Select 'Add Calculator' by pressing [enter]. How else could you select it?

   _____

5. Press [6][^][5] and [enter]. How does the problem appear on your screen? _____
   What is the answer? _____ Press [2][8][^] and explain what happens when you press [^].

   _____
   Where is the cursor located? _____ Find 28^3 _____.

6. Find 36^2 _____. There is a quicker way to type 36^2 without using [^]. Instead we can use the [x²]. Where is it located, and why is it faster this way? _____

7. Type [3][÷][8] and [enter]. What is the answer? _____
   Try [3][÷][8] again, only this time press [ctrl] and [enter]. What is the answer? _____
   One more time, type in [3][÷][8], but this time include a decimal point at the end and then press [enter]. What is the answer? _____

8. Press [ctrl][÷]. What appears on your screen? _____ Where is the cursor? _____
   Type in [1][2], press [tab], type in [9][8], and press [enter].
   What is the answer? _____ What did pressing [tab] do? _____

9. Press ▲ once so the last answer is highlighted, and then press [enter]. What happens?

   _____
   Press ◀ once. Where is the cursor? _____

Delete the current number by pressing [del]. Type in [2][8], and press [enter]. What is the answer?

_____

10. Press ▲ several times, and then press [enter]. Try this a few times. What happens?

_____

11. Press ▲ twice (to highlight the last problem you entered) and press [del]. What happens?

_____

Press [del] several more times. What is happening each time you press [del]?

_____

12. Press [ctrl] and ▲. What do you see? _____
Press [del] [enter]. What does the screen say? _____

13. Press [ctrl] [0]. This is a calculator screen, but what looks different about it? _____
Now type in [3] [(] [5] [−] [8] and [enter]. What is the answer? _____
You typed in 3(5-8, but what does the problem look like on the handheld? _____

14. Press [ctrl] [x²] to get a square root. Then type [2] [3] [−] [7], move one space to the right, and type [+] [2] [enter]. What is the answer? _____
What does the problem look like on the screen? _____
What happened to the square root bar? _____
Where did the cursor move when you moved one space to the right? _____

15. Press [(] [(−)] [1] [7] [)] [x²] [enter]. What is the answer? _____
What makes the [(−)] button different from the [−] button? _____

16. Press [on], and open a New Document. Select 'No' when it asks if you want to save the document.
Press [ctrl] [on] to turn off the handheld. **These are the last things you should do on your handheld before you put it away each day!**

17. How can you clear your screen entirely? _____

18. How can you recall the last answer? _____

19. How do you know where you are typing on the Calculator screen? _____

20. How can you make sure your answer is in the form of a decimal and not a fraction?

_____

Transferring Documents Between Handhelds

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to transfer a document from one TI-Nspire™ CX handheld to another.

Materials

- Two TI-Nspire™ CX handhelds
- Unit-to-unit connection cable (Mini-A to Mini-B USB)

Transferring a Document or a Folder

Documents can be transferred between two TI-Nspire™ CX handhelds by connecting them with the unit-to-unit mini USB cable. The USB A port is located at the top of the handheld on the right side.

Step 1:

Firmly insert the ends of the mini USB unit-to-unit cable into the USB A ports of the handhelds. The handhelds will automatically turn on when the cable is plugged in.

Step 2:

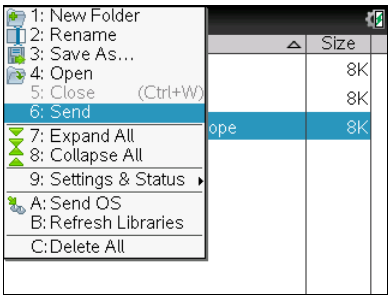
Open **My Documents** on the sending handheld.

Step 3:

Press the ▲ and ▼ keys to highlight the document or folder to send.

Step 4:

Press [menu] and select **Send**. No action is required by the user of the receiving TI-Nspire™ CX handheld. Once the transfer begins, a progress bar displays the status of the transfer. When the transfer is complete, a message displays on the receiving handheld. If the document was renamed on the receiving handheld, the new document name appears.



Note: When sending a folder from one handheld to another, the file structure in the sending folder is retained. If the folder does not exist on the receiving handheld, it will be created. If the folder does exist, files will be copied into it, with appended names added to any duplicate files.

Note: To cancel a transmission in progress, select **Cancel** in the dialog box of the sending handheld. To cancel a transfer from the receiving handheld, press [esc]. The receiving handheld, however, cannot cancel a transfer of folders. If an error message appears, press [esc] or [enter] to clear it.

Guidelines for Transferring Documents or Folders

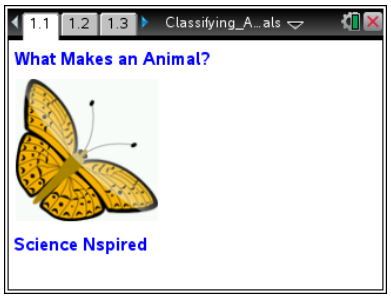
The guidelines for sending an individual document also apply to documents within folders that are sent.

- If you send a document with the same name as an existing document on the receiving TI-Nspire™ CX handheld, the system renames the sent document by appending a number to the name. For example, if you send a document named *Mydata* to another TI-Nspire handheld that already contains a document named *Mydata*, the document you send will be renamed *Mydata(2)*. Both the sending and receiving units display a message that shows the new name.
- There is a 255-character maximum length for a document name, including the entire path. If a transmitted document has the same name as an existing document on the receiving handheld and the document names contain 255 characters, then the name of the transmitted document will be truncated to allow the software to follow the renaming scheme described in the previous bullet.
- All variables associated with the document being transmitted are transferred with the document.
- Transmissions will time out after 30 seconds.

What Makes an Animal?
Student Activity

Name _____
Class _____

Open the *What_Makes_an_Animal.tns* file.



What makes animals so special? What distinguishes the animal Kingdom from the other kingdoms? What do animals as seemingly different as cats, birds, and sea urchins really have in common?

In this lesson, you will learn some of the general characteristics of animals, and you will practice distinguishing one animal from another.

Zoology, the study of animals, covers the huge range of organisms in the Kingdom Animalia. There are more than 2 million species in this Kingdom, but they all have more in common with each other than with species from other kingdoms!

You will learn the five characteristics of all animals, and then use a dichotomous key to identify some of these animal species.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

Move to pages 1.3 – 1.4.

1. Read the information about animals. Page 1.3 discusses the connection between animals and eukaryotic cells. Page 1.4 discusses how animals are multicellular.

Answer question 1 here and/or in the .tns file.

Q1. Name one multicellular eukaryote that is NOT an animal.

Move to page 1.6.

2. Read the information about why animals are heterotrophs.

Answer question 2 here and/or in the .tns file.

Q2. If an organism is not a heterotroph, it might be classified as a(n)_____.

Move to pages 1.8 – 1.9.

3. Read the information on animal movement and animal development.

Answer questions 3–5 here and/or in the .tns file.

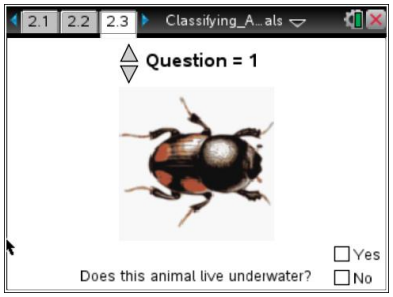
Q3. A mushroom must consume food (decaying plant material). Is it an animal? Explain.

Q4. Why is motility important for animals?

Q5. Does an organism need a backbone to be an animal? Explain.

Now that you have been introduced to the Animal Kingdom, you will use a tool, called a dichotomous key, that biologists use when identifying organisms. A dichotomous key asks a series of yes or no questions based on observable traits in order to identify an organism. A unique set of answers points to the correct animal. This can be adapted and used as a helpful tool for identification of organisms in the wild.

Move to pages 2.1 – 2.3.



4. Read the directions in the pop-up box for completing the simulation of the dichotomous key. To close the directions, can click the ☒. Answer the questions for all nine animals. If the name that appears at the end of the questions does not match what you think the animal is, click the down arrow to go to revisit the questions.

   If needed at any time during the simulation, press menu to view the directions again.

Answer questions 6–16 in the .tns file. Answer questions 17–19 here and/or in the .tns file.

Q17. For which three animals were you asked about having wings?

A. Butterfly
B. Frog
C. Beetle
D. Snail

Q18. For which two animals were you asked about a tail?

A. Lizard
B. Fish
C. Frog
D. Whale

Q19. Which of the organisms you classified met the five characteristics of animals?

A. Beetle
B. Butterfly
C. Fish
D. Frog
E. Horse
F. Lizard
G. Snail
H. Starfish
I. Whale

What Makes an Animal?

SCIENCE NSPIRED

TEACHER NOTES

Science Objectives

- Students will learn the five basic characteristics of the animal kingdom.
- Students will learn to use a dichotomous key to distinguish one animal from another.

Vocabulary

- zoology
- organelle
- heterotroph
- motile
- body plan
- dichotomous key
- eukaryote
- multicellular
- autotroph
- sessile
- developmental stage

About the Lesson

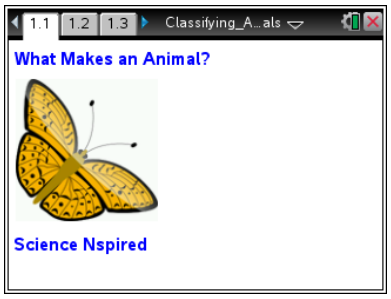
- In this lesson students learn about basic animal biology and identification of different animal species.
- Students will:
  - Identify and describe the five characteristics of all organisms in the Animal Kingdom.
  - Contrast these characteristics with those of other kingdoms.
  - Use a dichotomous key to identify nine different species of animals.

TI-Nspire™ Navigator™

- Send out the *What_Makes_an_Animal.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- *What_Makes_an_Animal.tns* document
- TI-Nspire™ Technology



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Open a Directions Box

Tech Tips:

Make sure that students understand how to select an answer to a question using enter.

Lesson Materials:

Student Activity

- What_Makes_an_Animal_Student.doc
- What_Makes_an_Animal _Student.pdf

TI-Nspire document

- What_Makes_an_Animal.tns

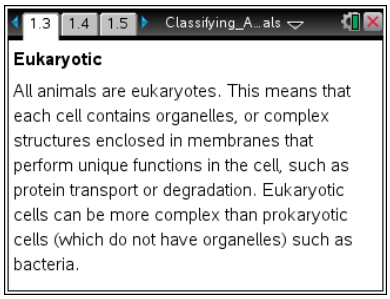
Discussion Points and Possible Answers

Allow students to read the introduction on the activity sheet.

Move to pages 1.3 – 1.4.

1. Students will read information about the first two characteristics of animals, eukaryotic cells and multicellular.

   Students will be introduced to the five characteristics of animals. Classroom discussion could compare and contrast these traits to other kingdoms.



Have students answer question 1 on the activity sheet, in the .tns file, or both.

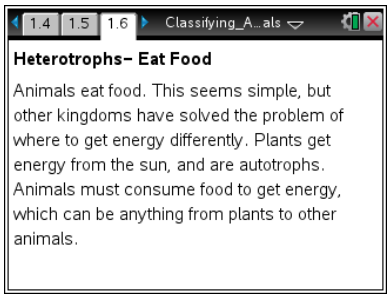
Q1. Name one multicellular eukaryote that is NOT an animal.

Sample Answers: Any plant or fungus, not bacteria

Move to page 1.6.

2. Students will read information about the third characteristic of animals, eating food.

   Autotrophs don't require energy in the form of fixed carbon. There are many bacteria which are autotrophs. An auxotroph is similar, although requires a specific nutrient in its diet.



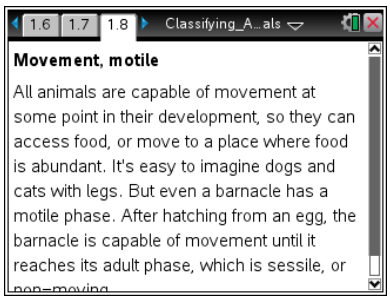
Have students answer question 2 on the activity sheet, in the .tns file, or both.

Q2. If an organism is not a heterotroph, it might be a(n)_____.

Sample Answers: autotroph or auxotroph.

Move to pages 1.8 – 1.9.

3. Students will read information about the fourth and fifth characteristics of animals, movement and a fixed body plan.



Have students answer questions 3–5 on the activity sheet, in the .tns file, or both.

Q3. A mushroom must consume food (decaying plant material). Is it an animal? Explain.

Sample Answer: No, mushrooms are a fungus. They are not motile and have no fixed body plan or developmental stage.

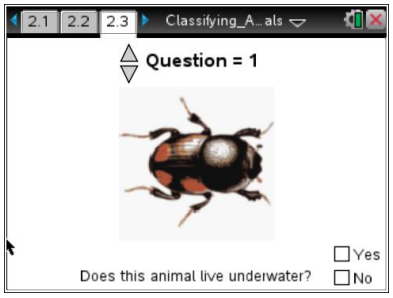
Q4. Why is motility important for animals?

Sample Answer: Heterotrophs need to get to food- either by going to it, or settling in a place where it will be (as in sea urchins and barnacles)

Q5. Does an organism need a backbone to be an animal? Explain.

Sample Answer: No. Bugs and worms are examples of invertebrate animals. 'Vertebrate' is a more narrow classification of certain animals.

Move to pages 2.1 – 2.3.



4. Students are to read the directions in the pop-up box for completing the simulation of the dichotomous key. To close the directions, they can click the ☒. They need to answer the questions for all nine animals, before answering the assessment questions that follow the simulation. If the animal name that appears at the end of the questions does not match with the picture, students can click the down arrow of the clicker to revisit the questions and change their answer(s).

   If needed at any time during the simulation, students can press menu if they would like to view the directions again.

Have students answer questions 6–16 in the .tns file.

Q6. What animal is this?

Answer: A. Beetle

Q7. What animal is this?

Answer: H. Starfish

Q8. Does this animal demonstrate motility?

Answer: Yes

Q9. What animal is this?

Answer: F. Lizard

Q10. What animal is this?

Answer: B. Butterfly

Q11. Is this animal a heterotroph?

Answer: Yes

Q12. What animal is this?

Answer: E. Horse

Q13. What animal is this?

Answer: G. Snail

Q14. What animal is this?

Answer: I. Whale

Q15. What animal is this?

Answer: C. Fish

Q16. What animal is this?

Answer: D. Frog

Have students answer questions 17–19 on the activity sheet, in the .tns file, or both.

Q17. For which three animals were you asked about having wings?

Answer: A. Butterfly, C. Beetle, D. Snail

Q18. For which two animals were you asked about a tail?

Answer: A. Lizard, C. Frog

Q19. Which of the organisms you classified met the five characteristics of animals?

Answer: All

TI-Nspire Navigator Opportunities

Choose a student to be a Live Presenter to demonstrate how to negotiate the animal identification simulation. The questions in the activity may be distributed as Quick Polls or used as a formative or summative assessment.

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.

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Punnett Pea Predictor

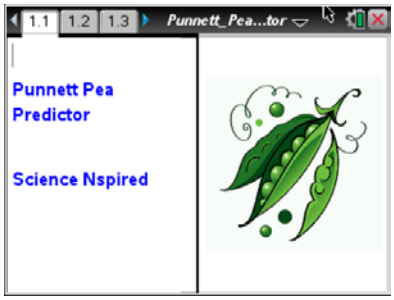
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Punnett_Pea_Predictor.tns.*

An allele is an alternative form of a gene located at a specific position on a specific chromosome, a DNA molecule. Alleles determine traits that can be passed on from parents to offspring. In many cases, a trait is determined by one pair of alleles—one allele from each parent. Complete dominance occurs when one allele is dominant and the other is recessive.



Move to pages 1.2 – 1.4.

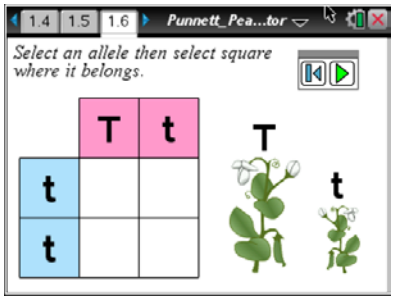
Read the background information for this simulation in the .tns and/or below.

The dominant allele is expressed and the recessive allele is masked. If an organism's **genotype** is homozygous, then the two alleles are the same; two dominant or two recessive. If the genotype is heterozygous, one of each allele is present. An organism's **phenotype** is the trait that is outwardly expressed by the organism.

The example explored here, height in pea plants, is determined by one pair of alleles: tall (T) is dominant and short (t) is recessive. The letters "T" and "t" are used to describe the genotype. The terms "tall" and "short" are used to describe the phenotype.

Move to pages 1.5 and 1.6.

2. Read the directions for the simulation on page 1.5. In the simulation on page 1.6, drag pairs of alleles into the correct box of the Punnett square to show the genotypic ratio for the F1 (first) generation. Using the genotypes, you can also determine the phenotypic ratio. Make sure you drag TWO alleles into each box in the Punnett square, since each individual must have two alleles for this trait!



Tech Tip: To drag an allele, select T or t, then move to the desired square. Select the square to drop the allele. Select ▶ to check the Punnett square. Then, select ⏮ to clear and obtain a new Punnett square.

Tech Tip: Tap or drag an allele, T or t, then move to the desired square. Tap again to drop the allele. Tap play ▶ to check the Punnett square. Then, tap ⏮ to clear and obtain a new Punnett square.

Punnett Pea Predictor

Student Activity

Name _____

Class _____

3. Run the simulation several times until you discover the pattern of height inheritance in pea plants. Then answer the questions below. If you need to, return to the simulation.

Move to pages 1.7 – 1.12. Answer the following questions here or in the .tns file.

Q1. Two tall parent pea plants will produce tall offspring.

A. always B. sometimes C. never

Q2. Two short parent pea plants will produce short offspring.

A. always B. sometimes C. never

Q3. One parent pea plant is heterozygous for height. In order to have an equal chance of producing tall or short offspring, the other parent pea plant must be _____.

A. heterozygous
B. homozygous (tall)
C. homozygous (short)
D. The genotype of the other parent does not matter. There can never be an equal chance.

Q4. One parent pea plant is homozygous tall. In order to have an equal chance of producing tall or short offspring, the other parent pea plant must be _____.

A. heterozygous
B. homozygous (tall)
C. homozygous (short)
D. The genotype of the other parent does not matter. There can never be an equal chance.

Q5. How many different parent combinations could lead to an equal chance of tall or short offspring?

A. 0
B. 1
C. 2
D. 3

Q6. Explain your response to Question 5.

Punnett Pea Predictor

SCIENCE NSPIRED

TEACHER NOTES

Science Objectives

- Students will use a Punnett square simulation to predict phenotypic and genotypic ratios of F1 generation.
- Students will predict parental genotypes.
- Students will explain the relationship between Punnett squares and probability.

Vocabulary

- allele
- dominant
- genotype
- heterozygous
- homozygous
- phenotype
- Punnett square
- recessive

About the Lesson

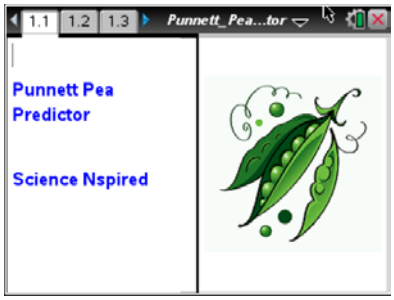
- This lesson allows students to explore patterns of genetic inheritance through a simulation.
- As a result, students will:
  - Manipulate Punnett squares to model the inheritance of height in pea plants.
  - Predict genotypic and phenotypic ratios of offspring.

TI-Nspire™ Navigator™

- Send out the *Punnett_Pea_Predictor.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software



Tech Tips:

- This activity includes class captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:

Student Activity

- Punnett_Pea_Predictor_Student.doc
- Punnett_Pea_Predictor_Student.pdf

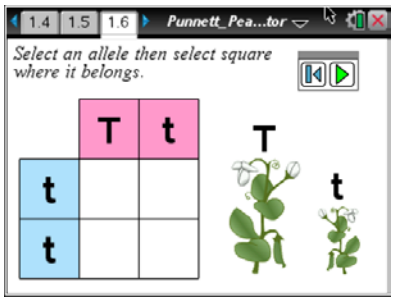
TI-Nspire document

- Punnett_Pea_Predictor.tns

Discussion Points and Possible Answers

1. Have students read the background information stated on their activity sheet and on pages 1.2 - 1.4 of the .tns file.

Move to pages 1.5 and 1.6.



2. Have students read the instructions for the simulation on page 1.4. On page 1.5, students will run the Punnett square simulation several times. Students should select the alleles on the right side of the page in order to drag them into the appropriate squares. You may need to remind them to make sure they put TWO alleles into each square. This would be a good time to review with them the need for two alleles for a trait—one coming from the mother and the other from the father.

Tech Tip: To drag an allele, have students select T or t, then move to the desired square. They should select the square to drop the allele. Have students select to check the Punnett square. They can, select to clear and obtain a new Punnett square

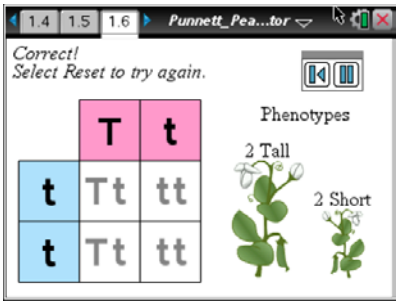
Tech Tip: Have students tap or drag an allele, a T or t, then move to the desired square. Tap again to drop the allele. Have students tap play to check the Punnett square. Then, have them tap to clear and obtain a new Punnett square.

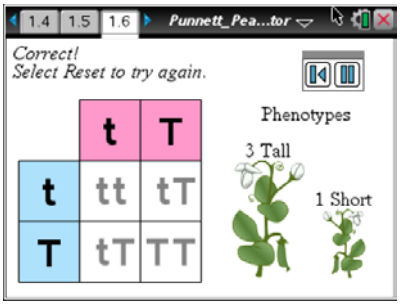
Teacher Tip: After the students have gone through a couple of simulations, ask them to predict results BEFORE filling in the Punnett square.

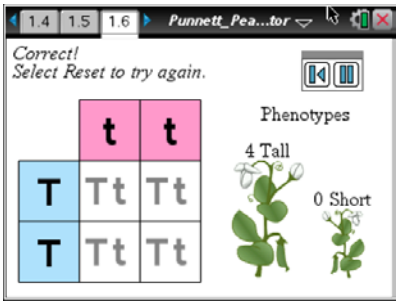
TI-Nspire Navigator Opportunities

Create a new Punnett square and project for the class to see. Have students predict what the results will be before filling in the square. Use the Tech Tip (below) to quickly complete the square and see if students' predications were correct.

Below are some possible results from the Punnett Square simulation.







3. Instruct students to repeat the simulation until they recognize the different patterns of height inheritance in pea plants.

Move to pages 1.7 – 1.12.

Have students answer the questions on either the device, on the activity sheet, or both.

Q1. Two tall parent pea plants will produce tall offspring.

Answer: B. sometimes

Q2. Two short parent pea plants will produce short offspring.

Answer: A. always

Q3. One parent pea plant is heterozygous for height. In order to have an equal chance of producing either tall or short offspring, the other parent pea plant must be _____.

Answer: C. homozygous (short)

Q4. One parent pea plant is homozygous tall. In order to have an equal chance of producing tall and short offspring, the other parent pea plant must be _____.

Answer: D. The genotype of the other parent does not matter. There can never be an equal chance.

Q5. How many different parent combinations could lead to an equal chance of tall and short offspring?

Answer: C. 2

Q6. Explain your response to the Question 5.

Answer: The parents have to be Tt and tt to have a chance to have an equal number of tall and short offspring.

Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

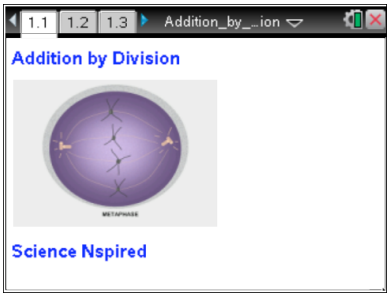
Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved by TI-Nspire Navigator. The TI-Nspire Navigator Slide Show can be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test, inquiry project, performance assessment, or an application/elaborate activity.

Addition by Division
Student Activity

Name _____
Class _____

Open the TI-Nspire document *Addition_by_Division.tns*.



Did you know that you are a product of mitosis? Your hair, skin and fingernails are constantly being replaced at a rapid rate; in fact, the outer layer of your skin will all be new in just 3 weeks from now! But this is not true of all of your cells. Your nerve cells, for the most part, stopped reproducing after you were a few months old. The life span of your red blood cells is only about 120 days, while the cells of liver tissues can take up to a year to reproduce!

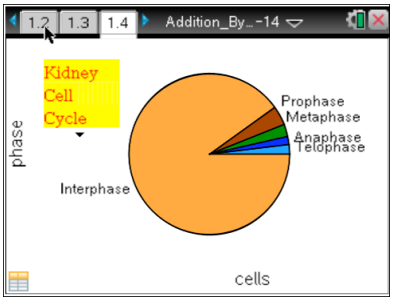
The cell cycle consists of two main segments: interphase and mitosis. Most of the cell's existence is spent in Interphase. Mitosis is the process of cell division, when one cell replicates its DNA and other cell parts, and then divides into 2 identical cells. The process of mitosis takes about the same amount of time regardless of the type of cell. Interphase times vary, as you'll soon see.

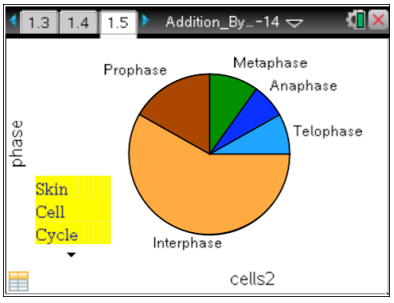
In this activity, you will learn how to identify the changes that occur in a cell during its reproduction. You will also correlate these changes to the duration of specific phases within the cell cycle.

Move to pages 1.4 and 1.5. Answer the following questions here.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

1. Pages 1.4 and 1.5 show pie chart models of the cell cycles of kidney cells and skin cells. Take a couple of minutes to examine both models, keeping in mind that the process of mitosis (which includes prophase, metaphase, anaphase and telophase) takes about the same amount of time in both kidney cells and skin cells. It is the interphase times that vary from cell type to cell type.





Q1. If the mitosis portion of the cell cycle lasts for 24 hours in both kidney cells and skin cells, estimate how long interphase lasts in each cell.

Kidney Cell _____ Skin Cell _____

Q2. Estimate how long each of the 4 mitotic phases (P,M,A,T) lasts in skin cell mitosis.

Prophase ____ Anaphase ____
Metaphase ____ Telophase ____

Q3. How long is each of the 4 phases in kidney cell mitosis?

Prophase ____ Anaphase ____
Metaphase ____ Telophase ____

Q4. Estimate the length of one entire cell cycle in each of the cells that was modeled.

Kidney Cell _____ Skin Cell _____

Q5. You're looking in a microscope at a tissue sample of living cells. In which stage of the cell cycle would you expect to find the most cells? In which stage would you expect to find the fewest cells?

Most _____ Fewest _____

Q6. Which of the two types of cells, kidney or skin, divides more often? How did you determine this? Why do you think this is so?

Q7. When, during a human's lifetime, would you expect to find lots and lots of cells undergoing mitosis? When would you expect to find fewer? Explain both your answers.

Q8. The process of mitosis produces new body cells for you. What are two reasons why your body needs to produce new cells?

Q9. Chemotherapy is a treatment given to cancer patients. Cancer cells typically have a short cell cycle, and chemotherapy often "attacks" non-cancerous cells that also have a short cell cycle. This is called a "side effect." What are some of the side effects of chemotherapy? Based on what you now know about the cell cycle, what causes these side effects?

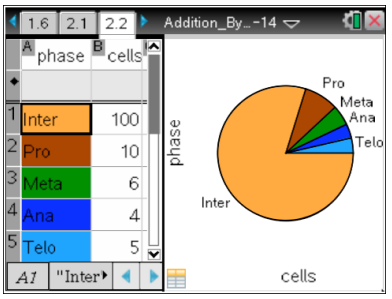
Addition by Division
Student Activity

Name _____
Class _____

Move to page 2.1.

A student looked at an onion root tip under a microscope and counted the cells that she observed in each phase of the cell cycle. She entered those cell numbers into a spreadsheet and then generated a pie chart representing the relative time that an onion root tip cell spent in each phase. Look at page 2.2 to see her results.

2. If possible, and as instructed by your teacher, do the actual cell counts and enter YOUR values in the spreadsheet column named "cells". To do this, simply use your arrow keys to move to the appropriate spreadsheet cell and enter your value for that phase. Continue until you have entered all 5 values for all 5 phases. Watch the pie chart adjust as you enter your numbers.



Q10. The entire cell cycle in an onion root tip cell lasts for about 24 hours. Based on your cell counts, how long does the entire process of mitosis last? How long does each of the 5 phases of the cell cycle last? Explain how you determined your answers.

Move to pages 3.1 and 3.2. Answer the following questions here or in the .tns file.

3. Move to page 3.1 and read the information on that page. Then proceed to page 3.2 for the simulation. After watching the simulation as many times as necessary, answer the following questions. These questions are also found following the simulation on your handheld.

Q11. What evidence can you see that the cell in the simulation is an animal cell?

Q12. During which phase does the nuclear membrane disappear?

A. Prophase
B. Metaphase
C. Anaphase
D. Telophase

Q13. In the cell shown, how many PAIRS of chromosomes are present?

A. 1
B. 2
C. 3
D. 4

Q14. What is the fibrous network called that is visible in the cell from prophase through anaphase?

A. the nucleus
B. chromatid web
C. centriole fibers
D. spindle apparatus

Q15. During which phase do the chromatids separate from one another?

A. Prophase
B. Metaphase
C. Anaphase
D. Telophase

Q16. At the end of the process shown, how many chromosomes are shown as present in each "new" cell?

A. 2
B. 4
C. 6
D. 8

Q17. If you had been watching a simulation of a human cell undergoing mitosis, how many chromosomes would have been present in each new cell?

A. 16
B. 23
C. 46
D. 92

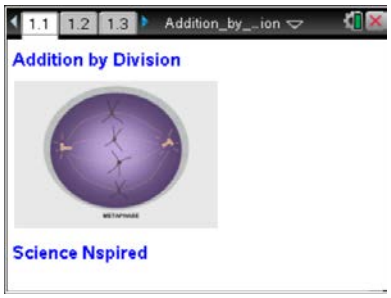
Addition by Division

SCIENCE NSPIRED

TEACHER NOTES

Science Objectives

- Students will identify the changes that occur in cells during each phase of the cell cycle.
- Students will correlate these changes to the duration of time cells spend in each phase.
- While looking at a section of an onion root tip, students will count the number of cells observed in each phase of the cell cycle They will then estimate the amount of time that a cell spends in each of the phases of the cell cycle.
- Students will watch a simulation of the process of mitosis and answer accompanying questions.



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages

Tech Tips:

Make sure that students understand how to select an answer to a question using enter.

Lesson Materials:

Student Activity

- Addition_by_Division_Student.doc
- Addition_by_Division_Student.pdf

TI-Nspire document

- Addition_by_Division.tns

Vocabulary

- anaphase
- cell cycle
- chemotherapy
- interphase
- metaphase
- mitosis
- prophase
- spindle apparatus
- telophase

About the Lesson

- In this lesson students investigate the cell cycle, which includes interphase and mitosis.
- Students will:
  - Identify the major changes that occur in a cell during each phase of the cell cycle by watching a simulation.
  - Correlate the time a cell spends in each phase with the number of cells in a rapidly dividing region of an onion root tip undergoing each phase.
  - Understand the implications of the differences between cells that have long or short cell cycles.
  - Evaluate how an understanding of the cell cycle helps healthcare providers in the treatment of cancer with chemotherapy.

TI-Nspire™ Navigator™

- Send out the *Addition_by_Division.tns* file.
- Monitor student progress using Screen Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- *Addition_by_Division.tns* document
- TI-Nspire™ Technology

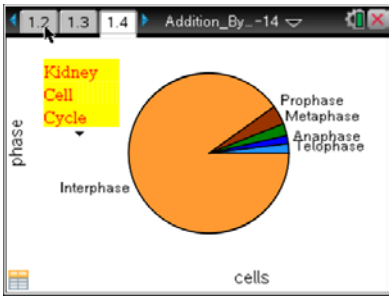
Discussion Points and Possible Answers

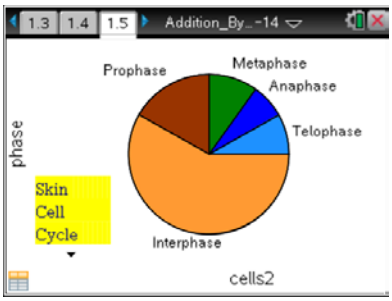
Move to pages 1.4 and 1.5.

Have students answer the questions on the activity sheet.

1. When the students analyze the pie charts of the cell cycles of kidney and skin cells, remind them that the mitosis portion of the cell cycle generally lasts for the same amount of time for each type of cell. The variation in the lengths of the cell cycle occurs in the interphase. For example, some cells may have a cell-cycle duration of 48 hours, of which half is in interphase and half is in mitosis. Liver cells, on the other hand, may divide only once a year, even though the mitosis portion may last only 24 hours, just as with a skin cell.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.





Q1. If the mitosis portion of the cell cycle lasts for 24 hours in both kidney cells and skin cells, estimate how long interphase lasts in each cell.

Answer: Kidney Cell: Approx. 8–9 days Skin Cell: Approx. 30 hours

Q2. Estimate how long each of the 4 mitotic phases (P,M,A,T) lasts in skin cell mitosis.

Answer: Prophase: 10 hours Metaphase: 6 hours
Anaphase: 4 hours Telophase: 4 hours

Q3. How long is each of the 4 phases in kidney cell mitosis?

Answer: Prophase: 10 hours Metaphase: 6 hours
Anaphase: 4 hours Telophase: 4 hours

Q4. Estimate the length of one entire cell cycle in each of the cells that was modeled.

Answer: Kidney Cell: Approx. 10 days Skin Cell: Approx. 55 hours

Q5. You're looking in a microscope at a tissue sample of living cells. In which stage of the cell cycle would you expect to find the most cells? In which stage would you expect to find the fewest cells?

Answer: Most: Interphase Fewest: Anaphase

Q6. Which of the two types of cells, kidney or skin, divides more often? How did you determine this? Why do you think this is this so?

Possible Answer: Skin cells divide more often. The cell cycle is shorter, which means that they go through mitosis more frequently. This is so because skin cells need to be replaced more frequently than kidney cells do.

Q7. When, during a human's lifetime, would you expect to find lots and lots of cells undergoing mitosis? When would you expect to find fewer? Explain both your answers.

Possible Answer: Find lots in a developing fetus, in an infant, during the “growth spurt” years. Find fewer in middle-age and beyond.

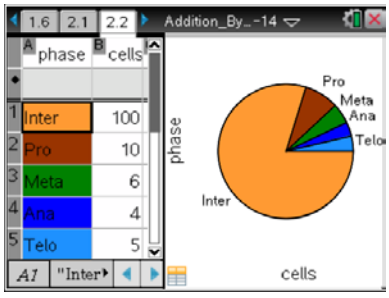
Q8. The process of mitosis produces new body cells for you. What are two reasons why your body needs to produce new cells?

Possible Answers: growth, repair, replacing dead cells

Q9. Chemotherapy is a treatment for cancer. Cancer cells typically have a short cell cycle, and chemotherapy often "attacks" non-cancerous cells that also have a short cell cycle. This is called a "side effect". What are some of the side-effects of chemotherapy? Based on what you now know about the cell cycle, what causes these side effects?

Possible Answer: Side-effects include nausea and hair falling out from the body. Chemotherapy targets cells—hopefully cancer cells—that divide frequently. Since the cells of the digestive lining, and the cells in hair follicles, also divide frequently, these become potential “targets” of the chemotherapy drugs, as well. In addition, anemia can result because of the destruction of red blood cells.

Discussion Points and Possible Answers



2. In this portion of the activity, students will interact with the .tns document. The spreadsheet on page 2.2 contains arbitrary data collected from an imaginary biology student. The student looked at a prepared microscope slide with a longitudinal section of actively dividing onion root tip tissue and counted the number of cells that she observed in each phase of the cell cycle. The numbers have been recorded in Column 2 of the spreadsheet, and then displayed in the adjacent pie chart. In order for your students to interact with this page, you may choose one of four possible options.

   Have students examine their own onion root tip slides and count the number of cells in each phase. If this is what you wish to do, have the students count cells while looking at the section on either medium or high power, and have them look in the area just “above” the tip of the root. If time permits,

have them do cell counts from 3-4 different areas on the same slide, or on different slides. and enter the total number of cells from all of the counts. The more cells they count, the more accurate their results may be.

Many biological supply companies sell “flash cards” with pictures of onion root tip sections on them. This is a quick, easy, and accurate way to count the cells, although the students will not be given the opportunity to use the microscope.

Have the students simply change the numbers in the spreadsheet to their liking. However, ask them to be realistic, as cell cycles always include more interphase than mitosis. You may wish to challenge them to change the numbers to generate pie charts that look identical to the pie charts included in Problem 1.

Have students actually prepare their own slides from living onion root tips. The protocol for that process will not be included here, but can be found on several websites.

Q10. The entire cell cycle in an onion root tip cell lasts for about 24 hours. Based on your cell counts, how long does the entire process of mitosis last? How long does each of the 5 phases of the cell cycle last? Explain how you determined your answers.

Answer: Answers will vary depending on the student cell counts.

Move to pages 3.1 and 3.2.

Have students answer the questions on either the handheld, on the activity sheet, or both.

3. Students should move to page 3.1, read the information on that page, and then proceed to page 3.2 for the mitosis simulation. After students have watched the simulation as many times as needed—they may pause and reset as many times as they’d like—they should answer the questions that follow. They may answer them on the handheld, to be collected via TI-Nspire Navigator, or they may be answered on the student .tns document.

Q11. What evidence can you see that the cell in the simulation is an animal cell?

Answer: The cell is round and there are centrioles present.

Q12. During which phase does the nuclear membrane disappear?

Answer: A. Prophase

Q13. In the cell shown, how many PAIRS of chromosomes are present?

Answer: A. 1

Q14. What is the fibrous network called that is visible in the cell from prophase through anaphase?

Answer: D. spindle apparatus

Q15. During which phase to the chromatids separate from one another?

Answer: C. Anaphase

Q16. At the end of the process shown, how many chromosomes are shown as present in each "new" cell?

Answer: A. 2

Q17. If you had been watching a simulation of a human cell undergoing mitosis, how many chromosomes would have been present in each new cell?

Answer: C. 46

TI-Nspire Navigator Opportunities

Use TI-Nspire Navigator to capture screen shots of student progress and to retrieve the file from each student at the end of the class period. The student questions can be electronically graded and added to the student portfolio.
Make a several students Live Presenters while doing Problem 2. Cell counts will be different from student to student, and it is interesting to see how these differences show up in the pie charts.
Additionally, the class screen capture feature allows you to see all (or at least most) of the students' handheld screens at one time. This is also a good way to compare the results that students get. In Problem 3, student answers may be collected and analyzed using TI-Nspire Navigator, if desired.

Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show. A possible extension would be to "pool" the class data from Problem 2 if the students are doing actual cell counts. This will make the numbers in the spreadsheet much larger, and it is interesting to observe whether the increased numbers of cells appreciably changes the distribution shown in the pie chart.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved by TI-Nspire Navigator. The TI-Nspire Navigator Slide Show can be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test, inquiry project, performance assessment, or an application/elaborate activity.
- Assessment questions are included on the Student Handout.

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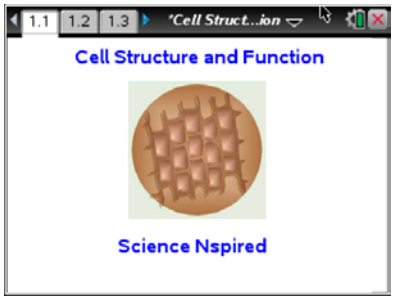
Cell Structure and Function

Student Activity

Name _____

Class _____

Open the TI-Nspire document *Cell Structure and Function.tns.*



All living things are made of cells. Some organisms, like bacteria or yeast, have only one cell. Other organisms, like you, are multicellular, which means they are made of many cells. In your case, many, MANY cells! Most of your cells have specific functions and a specialized structure. For example, a skin cell is different from a muscle cell or a kidney cell.

Since cells were first discovered by Robert Hooke in 1665, we have learned more about how cells function. Eukaryotic cells, such as yeast, animals and plants, have basic machinery in common that perform the essential tasks for life. In this activity, you will learn about the internal cell structures that support life within both animal and plant cells.

Part 1: Animal Cell

Move to pages 1.2 and 1.3. Read the background information below and/or in the .tns file.

In the first part of this activity, you will explore some of the structures in an animal cell. By selecting various internal cell structures called *organelles*, you will learn what each structure does for that cell.

Cells are the structural and functional units of life. **Structure** refers to what something is made of and **function** refers to how things work. All living things have at least one cell.
Organisms like bacteria are made of one cell. A human has trillions of cells. They give a person structure and allows their body to work efficiently.

In this activity, you will learn about some of the parts of animal and plant cells. These parts are **organelles**. Plant and animal cells have most organelles in common. There are some organelles that are contained in either plant OR animal cells.

Move to pages 1.4 – 1.8. Answer questions 1 – 5 here and/or in the .tns file.

Q1. Which of the following is an example of a unicellular organism?

A. a maple tree
B. a dog
C. a bacterium
D. a mushroom

Q2. Cells usually have different combinations of organelles, depending on their special function.

A. agree
B. disagree

Cell Structure and Function

Student Activity

Name _____

Class _____

Q3. What do you think is meant by the term *multicellular* organism?

A. an organism that has lots of cells
B. an organism that has one cell
C. an organism that is sometimes an animal and sometimes a plant
D. an organism with organelles

Q4. Which cell process is performed by plant cells, but **NOT** by animal cells?

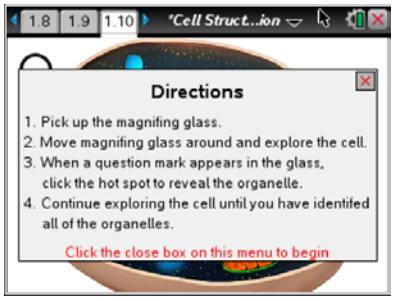
A. cell division
B. protein synthesis
C. photosynthesis
D. DNA replication

Q5 Large organisms have large cells and little organisms have little cells.

A. agree
B. disagree

Move to pages 1.9 and 1.10.

1. Read the instructions on page 1.9 about navigating the cell diagrams.



2. On page 1.10, move your cursor over a cell organelle and you will see a magnifying glass icon. Select on the cell organelle and you'll see a name and a description appear. **Take notes below** on the name of the organelle and its function. Continue to move throughout the cell until you have selected all of the organelles. Some parts of the cell cannot be selected and sometimes there is more than one of the same organelle. When you are ready, move to page 1.11 and answer the questions. Move back to the picture of the cell if you need help answering the questions.

Tech Tip: To explore the cell diagram, simply tap organelles in the image.

Cell Structure and Function

Student Activity

Name _____

Class _____

Tech Tip: To access the Directions again, select menu or **Document Tools ( ) > Cell Structure and Function > Directions.**

Tech Tip: To access the Directions again, select **> Cell Structure and Function > Directions.**

Move to pages 1.11 – 1.18. Answer questions 6 – 13 here and/or in the .tns file.

Q6. Which organelle did you NOT see in the animal cell?

A. golgi apparatus
B. chloroplast
C. mitochondria
D. endoplasmic reticulum

Q7. Mitochondria house important enzymes in the membrane. How is this reflected in the structure of the mitochondria?

Q8. Some white blood cells (WBC's) are called macrophages. These cells eat bacteria and other disease-causing agents and then destroy them with digestive enzymes. Which organelle do you think macrophages would have in abundance?

Q9. Why do you think release of the lysozyme enzymes can cause necrosis, death of body tissue?

Q10. Other WBC's, called B-lymphocytes, make and secrete proteins called antibodies. Which cell organelle would B-lymphocytes have a lot of?

A. chloroplasts
B. ribosomes
C. lysosomes
D. smooth ER

Q11. Prokaryotes, such as bacteria, do not have organelles. What other cell organelle would you predict that prokaryotes would NOT have?

A. plasma membrane
B. ribosomes
C. nucleolus
D. cytosol

Cell Structure and Function

Student Activity

Name _____

Class _____

Q12. Some cells in your glands secrete chemicals called hormones, which often have to be packaged up before being sent out of the cell. Which organelle would you probably find in great numbers in gland cells?

A. lysosomes
B. golgi apparatus
C. nuclei
D. plasma membrane

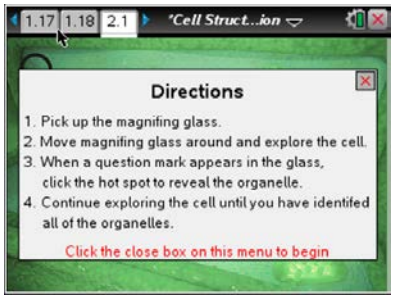
Q13. The cell membrane is made of a lipid bilayer, which is a greasy type of molecule. What does this do to the structure of the cell?

A. It makes the structure flexible.
B. It makes the structure soluble.
C. It makes the structure stiff.
D. It makes the structure porous..

Part 2: Plant Cell

Move to page 2.1.

3. Now you will take a look at a typical plant cell. Follow the same procedure that you did with the animal cell. Select each cell part and **take notes below** on the name of the organelle and its function in the space below. As you work through the plant cell, think about the differences between plant cells and animal cells.



Move to pages 2.2 – 2.9. Answer questions 14 - 21 here and/or in the .tns file.

Q14. Based on your observations, which of these organelles can ONLY be found in plant cells? Select all that apply.

A. mitochondria
B. chloroplasts
C. cell wall
D. rough ER

Q15. Both smooth and rough endoplasmic reticulum are responsible for transport. Where do their contents get transported to?

A. other organelles
B. cell wall
C. outside the cell
D. into the air

Q16. Which organelle contains grana?

A. cytoplasm
B. nucleus
C. chloroplast
D. vacuole

Q17. Plants inherit characteristics from their parents just as animals do. Which cell organelle contains the hereditary information?

A. vacuole
B. nucleus
C. golgi apparatus
D. nucleolus

Q18. Which pair of plant cell organelles deals with energy processing?

A. smooth ER and rough ER
B. golgi apparatus and smooth ER
C. chloroplasts and mitochondria
D. nucleolus and ribosomes

Q19. Plants have both chloroplasts and mitochondria, which can produce energy. Why does the cell have overlapping functions? Explain.

Q20. The vacuole in plants performs a similar function to which organelle in animals?

A. golgi apparatus
B cytosol
C. rough ER
D. lysosome

Q21. When a plant is dried for use as rope, which large organelle makes up most of the fibrous cellulose material that remains?

A. vacuole
B. cell wall
C. chloroplast
D. nucleus

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Cell Structure and Function

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TEACHER NOTES

Science Objectives

- Students will know the names and functions of the major organelles found in eukaryotic cells.
- Students will be able to contrast different cell types (plant and animal cells), based on their structure and function.

Vocabulary

- Organelle
- Unicellular
- Multicellular
- Necrosis
- Antibody
- Eukaryote
- Prokaryote
- Macrophage
- B-lymphocyte

About the Lesson

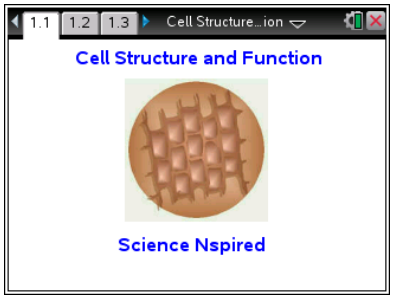
- Using cell model diagrams, students will interact with both animal and plant cells and explore the structure and function of the organelles. Assessments are embedded in the activity to encourage discussion and gauge learning.
- As a result, students will:
  - Learn the basic functions of the following animal cell organelles: nucleus, nucleolus, mitochondria, Golgi apparatus, ribosomes, lysosomes, rough endoplasmic reticulum, smooth endoplasmic reticulum, centrioles.
  - Learn the basic functions of the following plant cell organelles: cell wall, nucleus, chloroplasts, mitochondria, vacuole, Golgi apparatus, rough endoplasmic reticulum, smooth endoplasmic reticulum.

TI-Nspire™ Navigator™

- Send out the *Cell Structure_and_Function.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software



Tech Tips:

- This activity includes class captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:

Student Activity

- Cell_Structure_and_Function_Student.doc
- Cell_Structure_and_Function_Student.pdf

TI-Nspire document

- Cell Structure_and_Function.tns

Discussion Points and Possible Answers

Allow students to read the background information on the student activity sheet and/or the .tns file.

Part 1: Animal Cell

Move to pages 1.2 and 1.3.

1. Students should read the background information on pages 1.2 and 1.3. Following those pages, there are several questions that assess the students' background knowledge of cells. These questions would probably be best used for discussion after the students answer them.

Move to pages 1.4 – 1.8.

Have students answer questions 1 – 5 on the device, the activity sheet, or both.

Q1. Which of the following is an example of a unicellular organism?

Answer: C. a bacterium

Q2. Cells usually have different combinations of organelles, depending on their special function.

Answer: B. disagree

Q3. What do you think is meant by the term *multicellular* organism?

Answer: A. an organism that has lots of cells

Q4. Which cell process is performed by plant cells, but **NOT** by animal cells?

Answer: C. photosynthesis

Q5 Large organisms have large cells and little organisms have little cells.

Answer: B. disagree

Move to pages 1.9 and 1.10.

2. Page 1.9 contains some instructions to the student about navigating the animal and plant cell diagrams.

3. On page 1.10, students should move the cursor over various parts of the animal cell. When they encounter an icon that looks like a question mark inside a magnifying glass, they should select that cell part and **take notes** on the name of the organelle and its function in the space provided on the student activity sheet. After completing the search, they should move to the questions on page 1.11 and beyond. At any time, they may move back to the cell diagram and re-check the organelles.

Tech Tip: To explore the cell diagram, students can simply tap organelles in the image.

Move to pages 1.11 – 1.18.

Have students answer questions 6 - 13 on the device, the activity sheet, or both.

Q6. Which organelle did you NOT see in the animal cell?

Answer: B. chloroplast

Q7. Mitochondria house important enzymes in the membrane. How is this reflected in the structure of the mitochondria?

Sample Answer: To provide more space for these membrane proteins, the inner-membrane of the mitochondria is folded many times in cristae, creating a large surface area.

Q8. Some white blood cells (WBC's) are called macrophages. These cells eat bacteria and other disease-causing agents and then destroy them with digestive enzymes. Which organelle do you think macrophages would have in abundance?

Answer: lysosomes

Q9. Why do you think release of the lysozyme enzymes can cause necrosis, death of body tissue?

Sample Answer: The digestive enzymes in the lysosome destroy other cells structures that they come into contact with, which is why they are kept separate in the lysosome.

Q10. Other WBCs, called B-lymphocytes, make and secrete proteins called antibodies. Which cell organelle would B-lymphocytes have a lot of?

Answer: B. ribosomes

Q11. Prokaryotes, such as bacteria, do not have organelles. What other cell organelle would you predict that prokaryotes would NOT have?

Answer: C. nucleolus

Q12. Some cells in your glands secrete chemicals called hormones, which often have to be packaged up before being sent out of the cell. Which organelle would you probably find in great numbers in gland cells?

Answer: B. golgi apparatus

Q13. The cell membrane is made of a lipid bilayer, which is a greasy type of molecule. What does this do to the structure of the cell?

Answer: A. It makes the structure flexible.

Part 2: Plant Cell

Move to page 2.1.

4. After finishing the questions pertaining to the animal cell, students should move to Part 2, which covers the plant cell. The process will be the same as with the animal cell. Students should select that cell part and **take notes** on the name of the organelle and its function in the space provided on the student activity sheet.

Move to pages 2.2 – 2.9.

Have students answer questions 14 - 21 on the device, the activity sheet, or both.

Q14. Based on your observations, which of these organelles can ONLY be found in plant cells? Select all that apply.

Answer: B. chloroplasts and C. cell wall

Q15. Both smooth and rough endoplasmic reticulum are responsible for transport. Where do their contents get transported to?

Answer: A. other organelles, B. cell wall, C. outside the cell

Q16. Which organelle contains grana?

Answer: C. chloroplast

Q17. Plants inherit characteristics from their parents just as animals do. Which cell organelle contains the hereditary information?

Answer: B. nucleus

Q18. Which pair of plant cell organelles deals with energy processing?

Answer: C. chloroplasts and mitochondria

Q19. Plants have both chloroplasts and mitochondria, which can produce energy. Why does the cell have overlapping functions? Explain.

Sample Answer: Chloroplasts only provide energy when there is sunlight. Mitochondria can provide energy from sugar. Together, these provide the cell energy 24 hours a day.

Q20. The vacuole in plants performs a similar function to which organelle in animals?

Answer: D. lysosome

Q21. When a plant is dried for use as rope, which large organelle makes up most of the fibrous cellulose material that remains?

Answer: B. cell wall

TI-Nspire Navigator Opportunities

Choose a student to be a Live Presenter to demonstrate how to negotiate the cell diagrams. The questions in the activity may be distributed as Quick Polls or used as a formative or summative assessment

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.

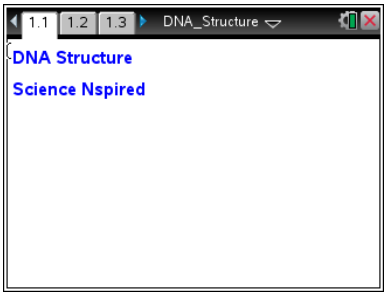
DNA Structure

Student Activity

Name _____

Class _____

Open the TI-Nspire document *DNA_Structure.tns.*



The "instructions" for the structure and function of all living things are contained in their DNA. All organisms rely on the same basic genetic code, using the same 4 building blocks (nucleotides) to make organisms ranging in complexity from yeast to you. A single deoxyribonucleic acid molecule, or DNA, can be millions of nucleotides long!

Life as we know it is possible because DNA can replicate, allowing us to grow and reproduce. Understanding the structure of DNA is important for understanding how DNA is replicated. The structure of DNA was first solved in 1953 by James Watson and Francis Crick. In this lesson, you'll learn about DNA structure by exploring several simulations.

Part 1: Introduction

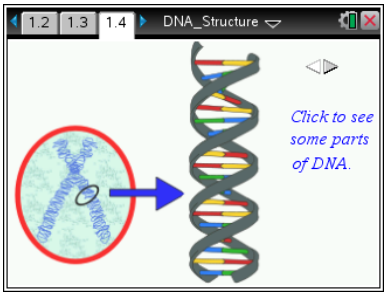
Move to pages 1.2 and 1.3.

DNA provides the molecular instructions that guide the building of all living organisms. It contains the genetic instructions to make an organism as complex as YOU As you will see in this lesson, the structure of DNA is actually very simple and quite repetitive. The basic building blocks are the same in all organisms from tiny bacteria to your pets!

1. By interacting with several simulations in this lesson you will learn, about the structure of DNA and how that structure influences its characteristics. On the next page, you'll see a diagram of some DNA. Follow the instructions on the page to learn about DNA before answering the questions on the following pages.

Move to page 1.4

This page shows a double helix, which is the basic three dimensional structure of DNA. Tap the "next" arrow to see some parts of DNA.



DNA Structure

Student Activity

Name _____

Class _____

Move to pages 1.5 – 1.6. Answer questions 1 and 2 here and/or in the .tns file.

Q1. How many separate strands of DNA are in the double helix?

A. 0
B. 1
C. 2
D. 3

Q2. The phosphate backbone is covalently bonded to a _____ .

A. nucleotide base
B. base pair
C. double helix
D. phosphate

Part 2: Chargaff's Rules

Move to pages 2.1 – 2.2.

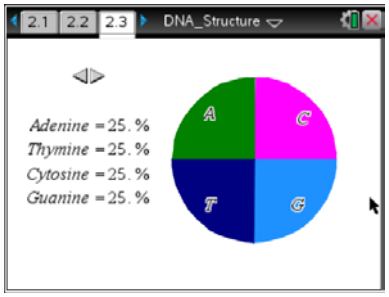
2. Chargaff was a scientist who studied DNA before the structure or function of this molecule was fully understood. He made two key observations that were essential for solving the structure of DNA. Read about him and his observations on pages 2.1 and 2.2.

   DNA has 4 nucleotide building blocks, also called "bases": adenine (A), thymine (T), cytosine (C), and guanine (G). Before the structure of DNA was known, Erwin Chargaff, an Austrian professor at Columbia University, made two essential observations about the bases which helped lay the groundwork for others to solve the double-helical structure of DNA.

   The first of Chargaff's rules was that in ANY sample of DNA from ANY organism, there is always about the same percentage of A as there is of T, and the same percentage of C as G. The second rule was that the amounts of A and T or C and G were similar on a single strand of DNA.

Move to page 2.3.

3. In this simulation, you can change the amount of each base in a hypothetical sample of DNA to see how it affects the percentages of the other three nucleotides, based on Chargaff's rules. Try several different combinations.



DNA Structure

Student Activity

Name _____

Class _____

Move to pages 2.4 – 2.6. Answer questions 3 – 5 here and/or in the .tns file.

Q3. Based on Chargaff's rules, which are the correct base pairs? (Select all that apply).

A. Adenine and Thymine
B. Thymine and Cytosine
C. Cytosine and Guanine
D. Guanine and Guanine

Q4. If a DNA molecule is 29% Guanine, what percent will be Thymine?

A. 21%
B. 25%
C. 27%
D. 29%

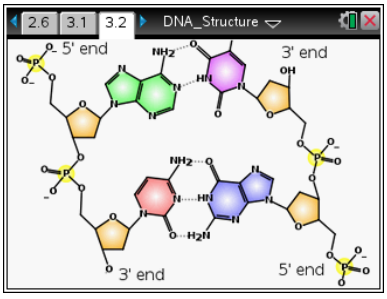
Q5. Are there limits to the amount of any base pair in DNA? For example, can you have DNA that is 52% A? Explain.

Part 3: DNA Structure

Move to page 3.1 – 3.2.

Now that you know more about the overall structure of DNA, you will take a closer look at the nucleotides to understand how each component of the structure influences the function of DNA. When the structure of DNA was solved, it became clear that both strands can be a template to create new DNA strands.

4. Next, you will look more closely at the molecular structure of DNA, including the specific types of molecular interactions and charges on the DNA molecule. When finished reading the Directions Box, select ☒ in the top right corner to close the pop-up box. Tap the wrench icon if you need to view the directions again.



Explore this simulation thoroughly before moving on to answer the questions on the following pages.

DNA Structure

Student Activity

Name _____

Class _____

Move to pages 3.3 – 3.5. Answer questions 6 – 8 here and/or in the .tns file.

Q6. Does DNA have an overall charge? Explain.

Q7. Which structure(s) is/are found in the backbone of DNA? (Select all that apply).

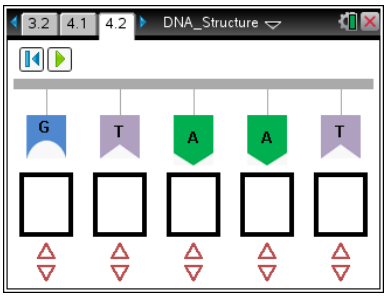
A. Deoxyribose
B. Hydrogen bond
C. Base pair
D. Phosphates

Q8. Is the base pair A-T bound more tightly than the base pair G-C? Explain.

Part 4: Base Pairing

Move to page 4.1 – 4.2.

5. Now that you have explored the structure of DNA, you will try to predict DNA sequences. On page 4.2, you will see a sequence of DNA. Use the up and down arrows to select the appropriate base to make a base pair for each base in the sequence. When you have completed all five bases, check your answer by taping the Play button. If you get one or more bases incorrect, press the Pause button to try again. To try a new sequence, select the Reset button.



Move to pages 4.3 – 4.4. Answer questions 9 – 10 here and/or in the .tns file.

Q9. Both strands have the same sequence of DNA.

A. True
B. False

Q10. One strand of DNA can be used to solve the sequence of its pair.

A. True
B. False

DNA Structure

SCIENCE NSPIRED

Science Objectives

Students will

- Learn about the structure of DNA, including base pairing.
- Be able to predict paired sequences of DNA.
- Understand how the structure of DNA affects its function.

Vocabulary

- nucleotide
- phosphate backbone
- adenine
- cytosine
- ribose
- base pair
- double helix
- thymine
- guanine
- deoxyribonucleic acid

About the Lesson

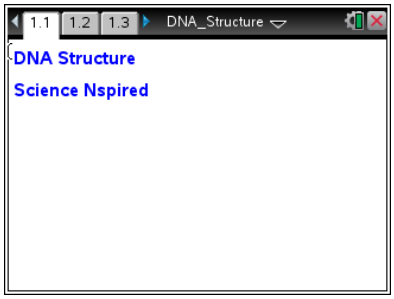
- Using a variety of simulations, students will interact with the structure of DNA to explore the building blocks and double helical structure of DNA. Assessments are embedded in the activity to engage discussion and gauge learning.
- As a result, students will:
  - Learn to recognize the general structure of DNA and its nucleotides: a nitrogen base, a deoxyribose sugar, and a phosphate.
  - Learn to apply Chargaff's rules for base pairing, including predicting the sequence of paired DNA strands.

TI-Nspire™ Navigator™

- Send out the *DNA_Structure*.tns file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software



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- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:

Student Activity

- DNA_Structure_Student.doc
- DNA_Structure_Student.pdf

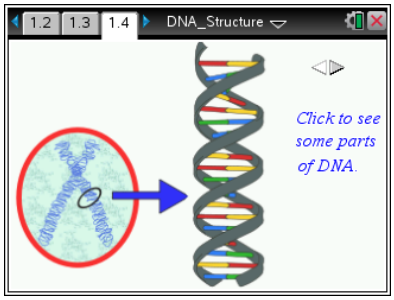
TI-Nspire document

- DNA_Structure.tns

Discussion Points and Possible Answers

Have students read the background information on the student activity sheet.

Part 1: Introduction



Move to pages 1.2 – 1.4.

1. Students should read the background information on pages 1.2 and 1.3, and then look at the figure on page 1.4. Following those pages, there are several questions that assess the students' general knowledge of DNA structure.

Move to pages 1.5 – 1.6.

Have students answer questions 1 – 2 on the device, the activity sheet, or both.

Q1. How many separate strands of DNA are in the double helix?

Answer: C. 2

Q2. The phosphate backbone is covalently bonded to a _____ .

Answer: A. nucleotide base

Each single strand of DNA is a single molecule, and the pair of DNA strands are held together by hydrogen bonds, as you'll see later.

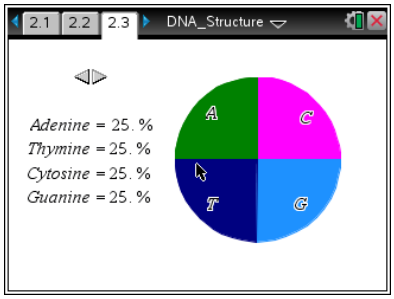
Part 2: Chargaff's Rules

Move to pages 2.1 – 2.2.

2. Students will get a brief introduction to Chargaff's rules as they read these pages. Before the structure of DNA was determined to be a double helix, Chargaff's rules indicated that A pairs with T, and G pairs with C. Students will learn about this from the text and the simulation.

Move to page 2.3.

3. Have students change the relative quantities of each base in a hypothetical DNA sample to see how it affects the other three nucleotides. They should try several different combinations before moving on the questions.



Tech Tip: Select the arrows to change the values of the chart.

Move to pages 2.4 – 2.6.

Have students answer questions 3 – 5 on the device, the activity sheet, or both.

Q3. Based on Chargaff's rules, which are the correct base pairs? (Select all that apply).

Answer: A. Adenine and Thymine and C. Cytosine and Guanine

Q4. If a DNA molecule is 29% Guanine, what percent will be Thymine?

Answer: A. 21%; 29% G will require 29% C, for a total of 58%. The remaining 42% will be half T and half A, 21% each.

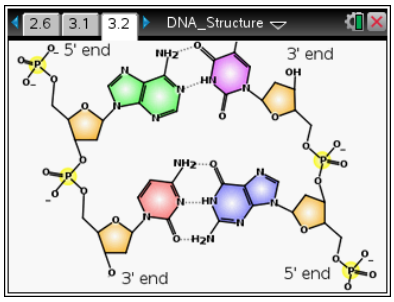
Q5. Are there limits to the amount of any base pair in DNA? For example, can you have DNA that is 52% A? Explain.

Suggested Answer: Yes, there are limits to the relative amounts of each base pair. A percentage equal to 52% of any nucleotide is not possible because each base requires a pair to satisfy Chargaff's rules.

Part 3: DNA Structure

Move to pages 3.1 – 3.2.

4. Students will receive a brief introduction to the next simulation on page 3.2. Have students read the directions in the pop-up box. They can select ☒ to close the directions and view the simulation.



Tech Tip: Press menu if you need to view the directions again.

Tech Tip: Select **Tools > Directions** to view the directions again.

This interactive page will allow students to select different parts of the molecular structure of DNA to learn about each component. Students should explore this simulation thoroughly before moving on to answer the questions on the following pages.

Move to pages 3.3 – 3.5.

Have students answer questions 6 – 8 on the device, the activity sheet, or both.

Q6. Does DNA have an overall charge? Explain.

Suggested Answer: Yes, DNA has a negative charge which comes from the phosphates in the backbone. The longer the DNA strand, the greater the total charge.

Q7. Which structure(s) is/are found in the backbone of DNA? (Select all that apply).

Answer: A. Deoxyibose, D. Phosphates

Teacher Tip: This question is a bit tricky. Have students try to visualize the structures that give the DNA ladder length, in contrast to the rungs, which are the bases.

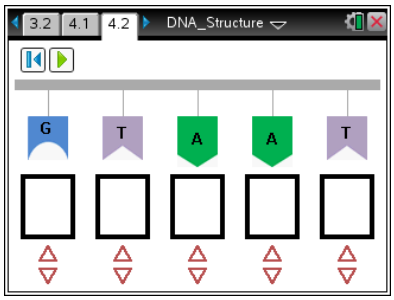
Q8. Is the base pair A-T bound more tightly than the base pair G-C? Explain.

Suggested Answer: No. G-C pairs have three hydrogen bonds which are stronger than the two hydrogen bonds of A-T base pairs.

Part 4: Base Pairing

Move to page 4.1 – 4.2.

5. Students will get instructions for the final simulation. This demonstration helps to check their base pair rules as they match a DNA sequence. On page 4.2, students should use the up and down arrows to select a nucleotide, and the play button to check their answer. Finally, they can use the reset button on the slide to create a new sequence to match.



TI-Nspire™ Navigator™ Opportunities

This would be a good activity to use the Class Capture and Presenter tools to have students work together on the same sequence, as sequences will be randomly generated.

Move to pages 4.3 – 4.4.

Have students answer questions 9 – 10 on the device, the activity sheet, or both.

Q9. Both strands have the same sequence of DNA.

Answer: False

Q10. One strand of DNA can be used to solve the sequence of its pair.

Answer: True

TI-Nspire™ Navigator™ Opportunities

Choose a student to be a Live Presenter to demonstrate the simulations. The questions in the activity may be distributed as Quick Polls or used as a formative or summative assessment

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire™ Navigator™. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.

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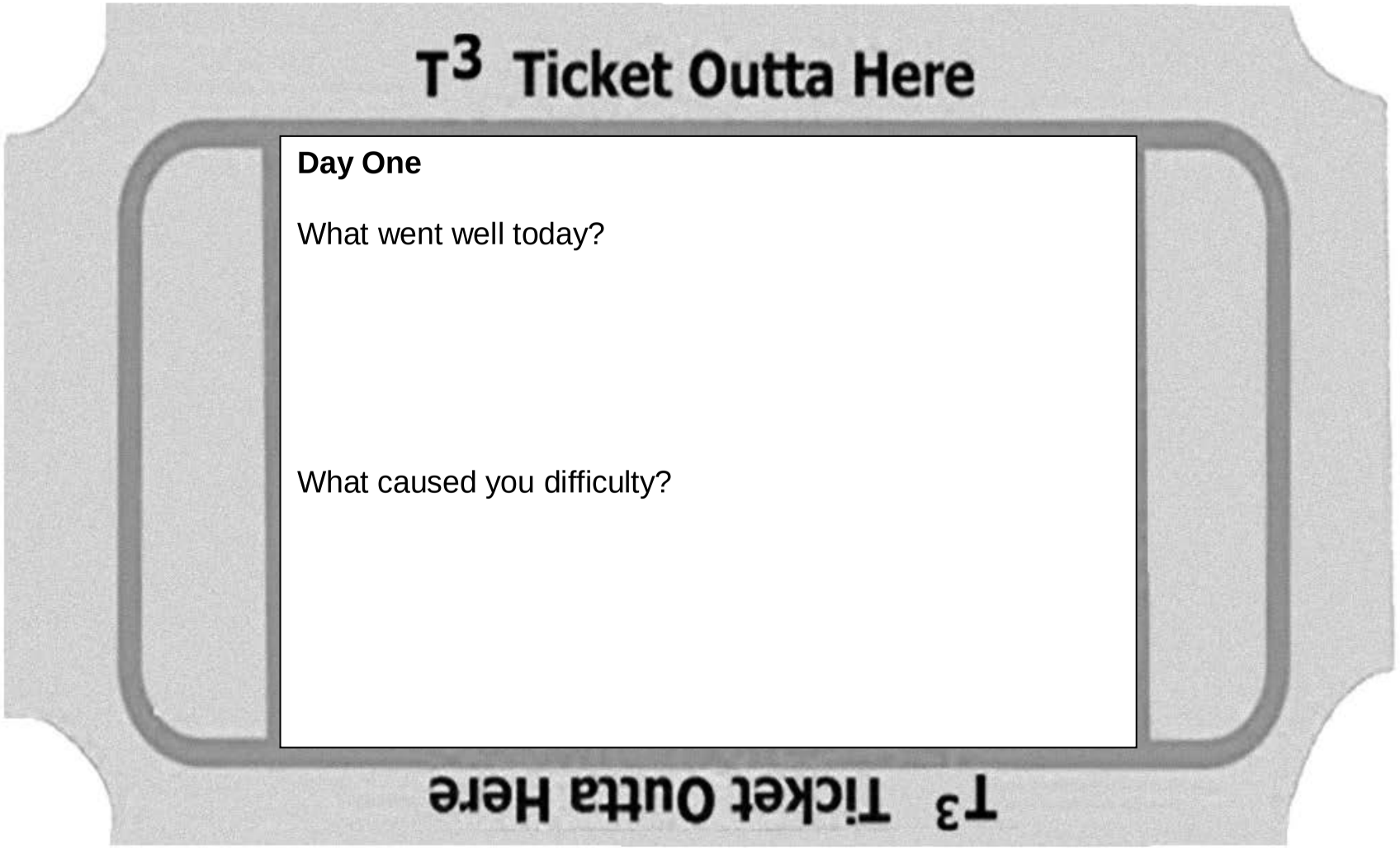
T3 Ticket Outta Here
Day One
What went well today?
What caused you difficulty?
T3 Ticket Outta Here

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TI-Nspire™ CX Family Overview

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will become familiar with the layout of the TI-Nspire™ CX family of handhelds.

Step 1:

Locate the Touchpad. The Touchpad is used to navigate the cursor around the screen. What appears in the center of the Touchpad?

Step 2:

Locate the keys to the left of the Touchpad. How do some of these keys compare in name and location to keys on a computer keyboard?

Step 3:

Note the light blue or yellow color of the commands that appear above many of the keys. Which key do you push to access the light blue or yellow options on the key pad?

Step 4:

Many of the traditional shortcut keys used with computer software are available on a TI-Nspire handheld. For example, ctrl C and ctrl V are used to "copy" and "paste," respectively.

Step 5:

Note the colors of various keys and the location of the alpha keys. What do you notice about the arrangement of the keys?

Step 6:

Where are the buttons for adding, subtracting, multiplying, and dividing located?

Step 7:

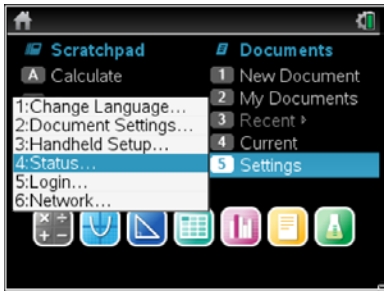
Press on to turn on the handheld. If the Home Screen is not displayed, press on again. Use the tab key to move to each of the Home Screen options. Note the applications available on the bottom row of the Home Screen.

Step 8:

Note the Scratchpad options available on the left hand side of the screen and the icon in front of the Scratchpad. Locate the Scratchpad key on the handheld.

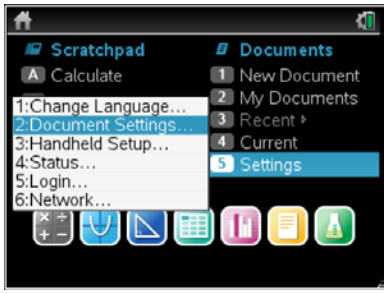
Step 9:

Select **Settings > Status** from the Home Screen. You will find the available memory and the battery status noted on the screen. Press esc or press ⚙ to choose OK to exit the Status screen.



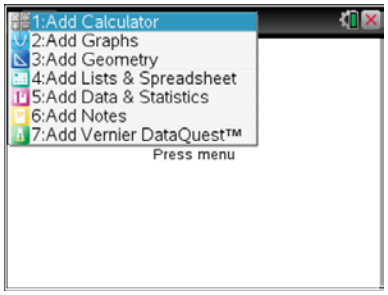
Step 10:

Select **Settings > Document Settings**. Explore the options available. Press esc or, using the Touchpad, move to OK and press ⚙ to exit the Document Settings menu.



Step 11:

From the Home Screen, select **New Document** to start a new document. If prompted to save the current document, select No. Choose **Add Calculator**. This Calculator page is the first page of the first problem in this new document. The tab indicating problem one, page 1 (1.1) is displayed in the top left corner of the screen.



Step 12:

Using the Touchpad, move the cursor to the icon to the left of the red **X** in the top right hand corner of the screen. What information is provided?

Checking and Updating the Operating System

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to check the operating system (OS) on a TI-Nspire™ CX handheld and update it using the TI-Nspire™ CX Teacher Software.

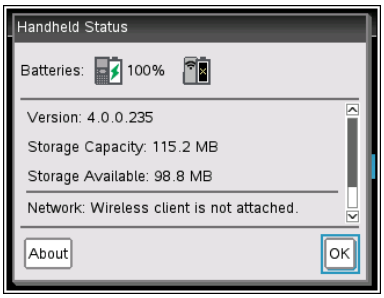
Materials

- TI-Nspire™ CX Teacher Software (v4.x) if using TI-Nspire™ CX handhelds
- TI-Nspire™ Teacher Software (v3.9) if using TI-Nspire™ CX, TI-Nspire™ with Touchpad, or TI-Nspire with Clickpad
- Standard-A to mini-B USB cable

Viewing Handheld Status

The Handheld Status screen displays the battery status, (OS) version, available space, the network (if any), and your student login name and whether you are logged in.

To view the Handheld Status, press on and select **Settings** > **Status**. The Handheld Status dialog box opens.



Note: The About screen displays the handheld type and product ID. To view the About screen from the Handheld Status screen, click **About**. To return to the Home screen, click **OK**.

Updating the Handheld OS

You can update the OS on your TI-Nspire™ handheld using the TI-Nspire™ Teacher Software or by transferring the OS from one handheld to another. OS upgrades do not delete user documents. If there is not enough room on the receiving handheld for the upgrade, the sending device is notified. The only time documents can be affected by an OS installation is if the receiving handheld has a corrupted OS. It is a good practice to back up important documents and folders before installing an updated OS.

Important OS Download Information

In the TI-Nspire™ family of handhelds, different handheld types require different operating systems:

- The OS for the TI-Nspire™ CX handheld has the file extension *.tco*.
- The OS for the TI-Nspire™ CX CAS has the file extension *.tcc*.
- The OS for the TI-Nspire™ with Touchpad or Clickpad has the file extension *.tno*.
- The OS for the TI-Nspire™ CAS with Touchpad or Clickpad has the file extension *.tnc*.

Always make sure the TI-Nspire CX handheld is fully charged before beginning an OS download (or, if using the TI-Nspire with Touchpad or Clickpad, install new batteries).

Finding Operating System Upgrades

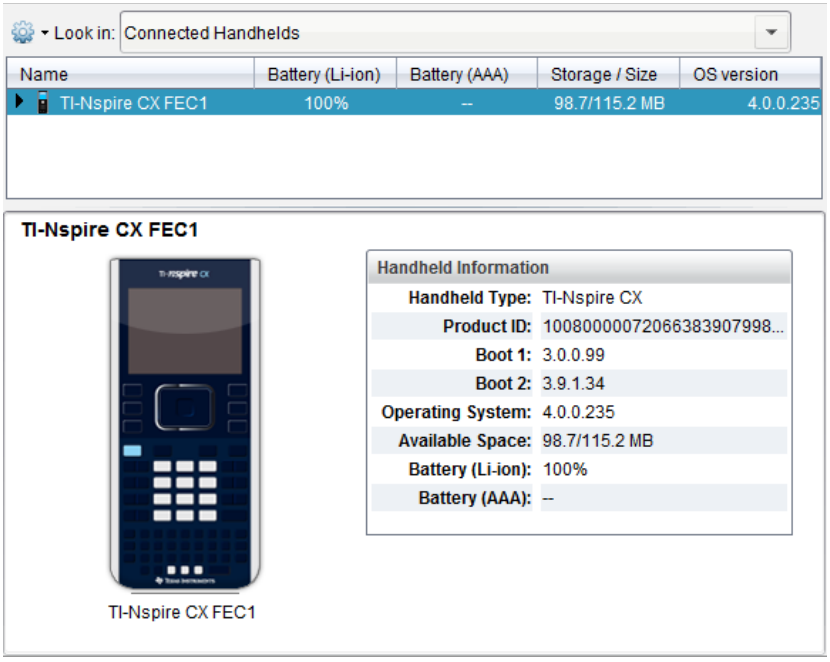
The Teacher Software links to helpful TI webpages, including those with handheld OS updates. You will need an Internet connection and USB connection cable to download and install the updates.

Checking and Updating the Operating System

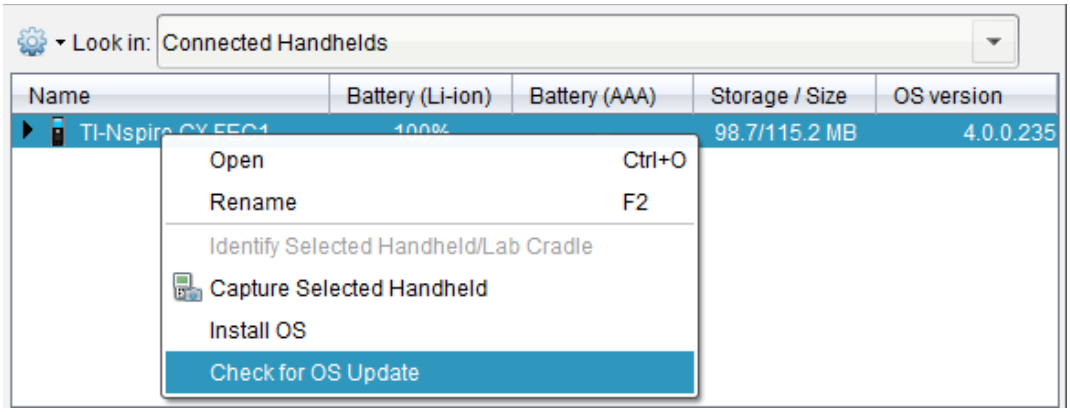
Using the TI-Nspire™ CX Teacher Software to Update the Handheld OS

Open the TI-Nspire Teacher Software and connect a TI-Nspire handheld to the computer using the USB connection cable. Go to the Document Workspace, select the Content Explorer tab, and click **TI-Nspire™ Connected Handhelds**. Multiple handhelds can be connected to the computer using multiple USB ports, USB hubs, or the TI-Nspire™ Docking Station. If multiple handhelds are connected to the computer, then multiple handhelds appear in the list of Connected Handhelds.

The connected handheld appears in the Content Window. Click on the name of the handheld to display battery, storage, and OS information. More detailed information appears in the Handheld Information window.



To see if a new OS is available, right-click on the row that includes the handheld's name. Select **Check for OS Update**. If there is a newer version of the OS available, follow the directions to install it. A window will inform you that any unsaved data will be lost. If you want to continue, select **Yes**.



The Press-to-Test Feature

TI PROFESSIONAL DEVELOPMENT

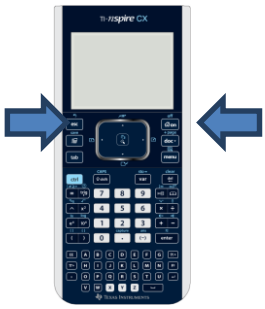
Activity Overview

- *The Press-to-Test feature allows you to quickly prepare student handhelds for exams by temporarily disabling folders, documents, and select features and commands. This activity explains how to enable and disable Press-to-Test, using either an additional TI-Nspire™ handheld or a computer with the TI-Nspire™ CX Teacher Software or TI-Nspire™ CX Navigator™ Teacher Software.*

Materials

- TI-Nspire™ handheld-to-handheld or handheld-to-computer USB connection cable
- TI-Nspire™ CX Teacher Software or TI-Nspire™ CX Navigator™ Teacher Software

Enabling Press-to-Test on Single TI-Nspire™ CX Handheld

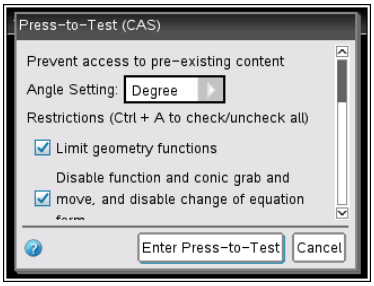


Step 1:

To enable Press-to-Test on the TI-Nspire™ with Touchpad and TI-Nspire CX™, first ensure that the handheld is turned off. Press and hold esc and on until the Press-to-Test screen appears.

Note: To enable Press-to-Test on TI-Nspire™ with Clickpad, press and hold esc, home, and on.

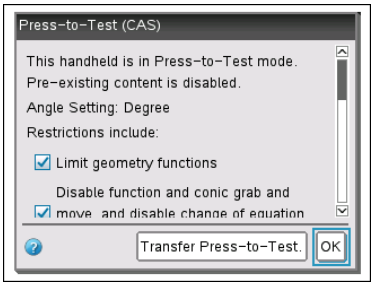
Step 2:



By default, Press-to-Test disables pre-existing Scratchpad data, documents, and folders as well as many other functionalities of the handheld. The angle settings can be changed by pressing ▶, selecting the appropriate setting, and pressing ▶ or enter.

By default, all of the commands and features listed are disabled. To enable a feature or command, uncheck its box. Keep all boxes checked, and enter Press-to-Test by clicking **Enter Press-to-Test**.

Step 3:



Once the handheld is in Press-to-Test mode, the handheld reboots. A dialog box confirms that the handheld is in Press-to-Test mode and the restrictions are listed. Click OK.

The Press-to-Test Feature

TI PROFESSIONAL DEVELOPMENT

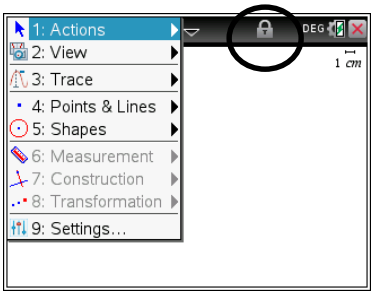
Step 4:

When in Press-to-Test mode, the LED at the top of the handheld begins blinking. Green indicates that all restrictions are selected (default), while yellow indicates that one or more restrictions are unselected. During the initial reboot, the LED alternates between red and, depending on the restrictions, either green or yellow.

Step 5:

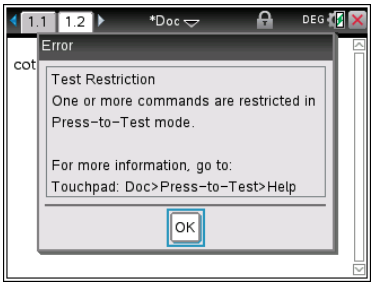
Create a new document, add a Geometry page, and press menu. Since geometry functions are limited, observe that the **Measurement**, **Construction**, and **Transformation** menus are not accessible.

Note: The lock icon at the top of the screen indicates that the handheld is in Press-to-Test mode.



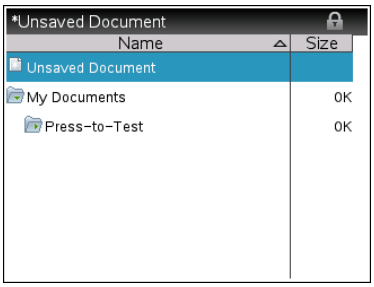
Step 6:

Add a Calculator application by selecting doc **> Insert > Calculator**. Type **cot(*π*/2)** and press enter. Since trigonometric functions are limited, an error message appears. The dialog box tells students how to access additional information about the restrictions. Click OK.



Step 7:

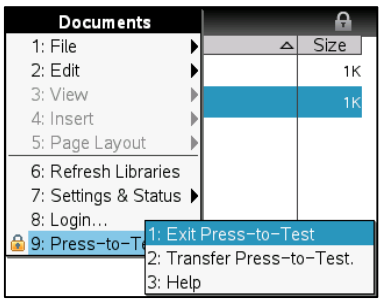
Select on **> My Documents.** While in Press-to-Test mode, a Press-to-Test folder appears in My Documents. All other folders and documents present on the handheld before Press-to-Test mode was entered are inaccessible.



Step 8:

To exit Press-to-Test mode, connect two handhelds using the handheld-to-handheld USB connection cable. Then select doc **> Press-to-Test > Exit Press-to-Test**. The Exit Press-to-Test option appears regardless of whether the other handheld is in Press-to-Test mode.

Press-to-Test can also be exited with the TI-Nspire™ Navigator™ Teacher Software. Once a class has been started, students can select doc **> Press-to-Test > Exit Press-to-Test**.



Entering Press-to-Test Using the TI-Nspire™ CX Teacher Software v. 4.2 or TI-Nspire™ CX Teacher Navigator ™ Software v. 4.2

Press-to-Test can be enabled on multiple devices using the TI-Nspire™ CX Teacher Software or TI-Nspire™ CX Teacher Navigator ™ Software. Individual restrictions can be marked, or unmarked, then enabled on all connected handhelds.

Step 10:

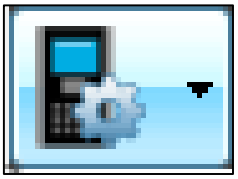
Open the TI-Nspire™ CX Teacher Software or TI-Nspire™ CX Teacher Navigator ™ Software.

Step 11:

Connect multiple TI-Nspire™ handhelds by using multiple USB ports, USB hubs, TI-Nspire™ Docking Stations or wireless network adapters. If multiple handhelds are connected, they will appear in the Connected Handhelds panel.

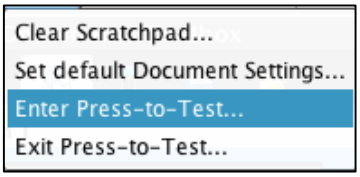
Step 12:

Press the **Prepare Handhelds** icon.



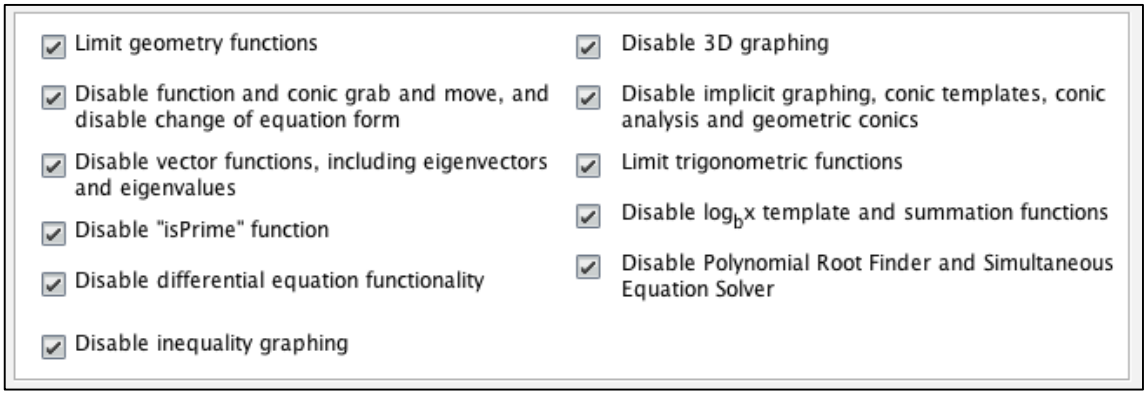
Step 13:

Choose **Enter Press-to-Test…**



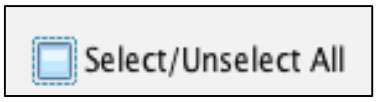
Step 14:

A window will open allowing you to choose specific restrictions to enable or disable.



Step 15:

Click to **Select All or Unselect All** at once.



Step 17:

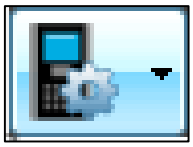
Once configurations have been selected, press **Enter Press-to-Test.**

Exiting Press-to-Test Using the TI-Nspire™ CX Teacher Software v. 4.2 or TI-Nspire™ CX Teacher Navigator ™ Software v. 4.2

Press-to-Test can be disabled on multiple devices using the TI-Nspire™ CX Teacher Software v 4.2 or TI-Nspire™ CX Teacher Navigator ™ Software v. 4.2

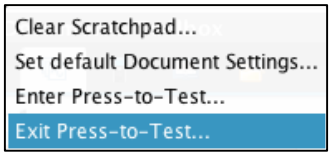
Step 18:

Press the **Prepare Handhelds** icon.



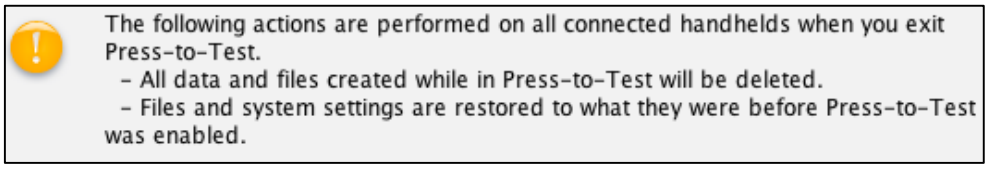
Step 19:

Choose **Exit Press-to-Test…**



Step 20:

A dialogue box will open to explain how the connected handhelds will be restored

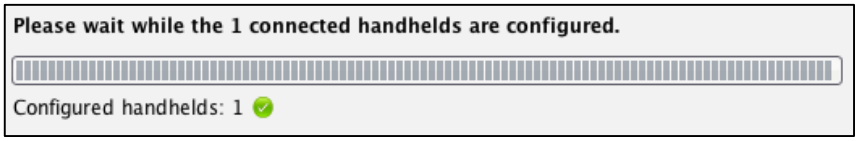


Step 21:

Click **Exit Press-to-Test**

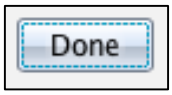
Step 21:

Progress of all connected handhelds will appear.



Step 22:

Press **Done** when all connected handhelds are configured.



Transferring Documents Between Handhelds

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to transfer a document from one TI-Nspire™ CX handheld to another.

Materials

- Two TI-Nspire™ CX handhelds
- Unit-to-unit connection cable (Mini-A to Mini-B USB)

Transferring a Document or a Folder

Documents can be transferred between two TI-Nspire™ CX handhelds by connecting them with the unit-to-unit mini USB cable. The USB A port is located at the top of the handheld on the right side.

Step 1:

Firmly insert the ends of the mini USB unit-to-unit cable into the USB A ports of the handhelds. The handhelds will automatically turn on when the cable is plugged in.

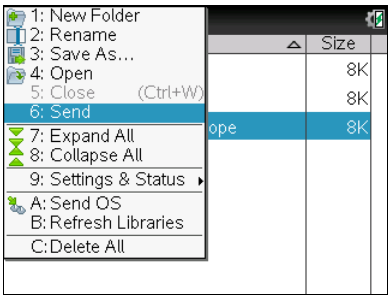
Step 2:

Open **My Documents** on the sending handheld.

Step 3:

Press the ▲ and ▼ keys to highlight the document or folder to send.

Step 4:



Press menu and select **Send**. No action is required by the user of the receiving TI-Nspire™ CX handheld. Once the transfer begins, a progress bar displays the status of the transfer. When the transfer is complete, a message displays on the receiving handheld. If the document was renamed on the receiving handheld, the new document name appears.

Note: When sending a folder from one handheld to another, the file structure in the sending folder is retained. If the folder does not exist on the receiving handheld, it will be created. If the folder does exist, files will be copied into it, with appended names added to any duplicate files.

Note: To cancel a transmission in progress, select **Cancel** in the dialog box of the sending handheld. To cancel a transfer from the receiving handheld, press esc. The receiving handheld, however, cannot cancel a transfer of folders. If an error message appears, press esc or enter to clear it.

Guidelines for Transferring Documents or Folders

The guidelines for sending an individual document also apply to documents within folders that are sent.

- If you send a document with the same name as an existing document on the receiving TI-Nspire™ CX handheld, the system renames the sent document by appending a number to the name. For example, if you send a document named *Mydata* to another TI-Nspire handheld that already contains a document named *Mydata*, the document you send will be renamed *Mydata(2)*. Both the sending and receiving units display a message that shows the new name.
- There is a 255-character maximum length for a document name, including the entire path. If a transmitted document has the same name as an existing document on the receiving handheld and the document names contain 255 characters, then the name of the transmitted document will be truncated to allow the software to follow the renaming scheme described in the previous bullet.
- All variables associated with the document being transmitted are transferred with the document.
- Transmissions will time out after 30 seconds.

Transferring Documents Using the TI-Nspire™ CX Teacher Software

TI PROFESSIONAL DEVELOPMENT

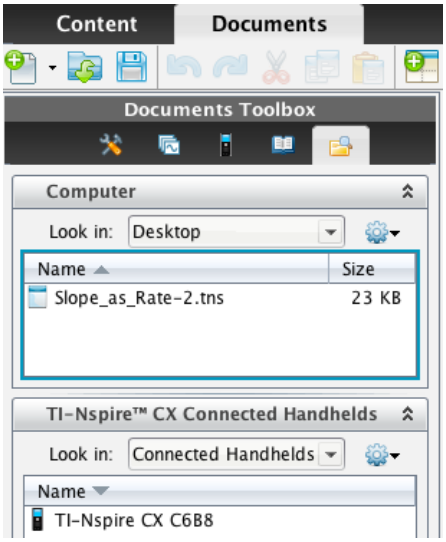
Activity Overview

In this activity, you will use the Documents and Content Workspaces of the TI-Nspire™ CX Teacher Software to transfer TI-Nspire™ documents between the computer and the handheld.

Materials

- TI-Nspire™ CX Teacher Software (v4.2) if using TI-Nspire™ CX handhelds
- TI-Nspire™ Teacher Software (v3.9) if using TI-Nspire™ CX, TI-Nspire™ with Touchpad, or TI-Nspire with Clickpad
- TI-Nspire™ handheld and standard-A to Mini-B USB cable

Transferring Documents in the Documents Workspace



Step 1:

Open the Teacher Software. Go to the Documents Workspace by clicking the **Documents** tab.

Step 2:

Connect a TI-Nspire™ handheld to the computer using the USB connection cable. Multiple handhelds can be connected using multiple USB ports, USB hubs, or the TI-Nspire™ Docking Station. If multiple handhelds are connected, then multiple handhelds appear in the Connected Handhelds panel.

Step 3:

Documents can be transferred between the computer and connected handhelds using the Content Explorer in the Documents Toolbox. Open the Content Explorer by clicking the **Content Explorer** tab.

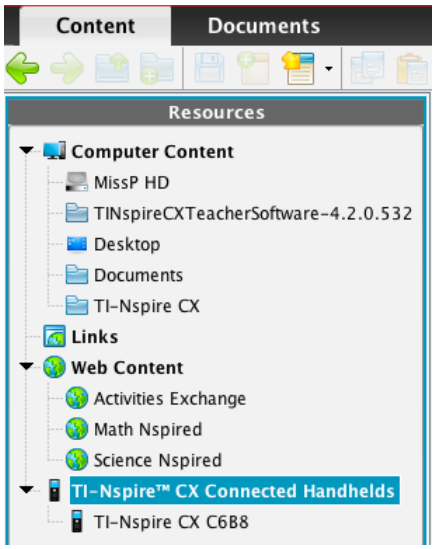
Step 4:

To transfer a TI-Nspire™ document from the computer to the handheld, locate the document in the Computer panel. Click, drag, and drop it into the handheld in the Connected Handhelds panel.

Step 5:

To transfer a TI-Nspire™ document from the connected handheld to the computer, locate the document in the Connected Handhelds panel. Click, drag, and drop it into the desired folder in the Computer panel.

Transferring Documents in the Content Workspace

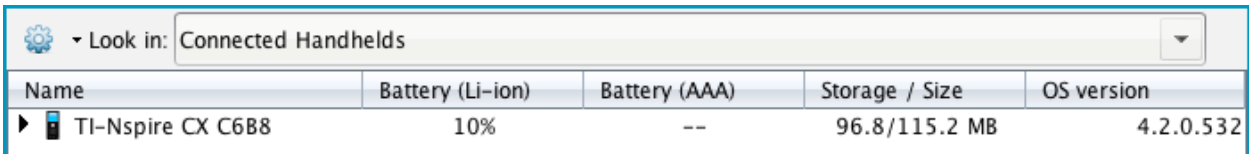


Step 6:

Go to the Content Workspace by clicking the **Content** tab. In the Resources panel select **TI-Nspire™ CX Connected Handhelds.**

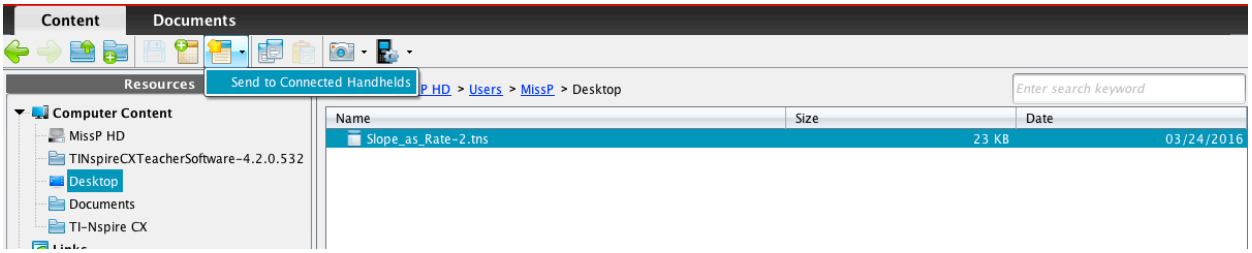
Step 7:

The connected handheld appears in the Content window, along with battery, storage, and OS information. To view the documents on a connected handheld, click the name of the handheld.



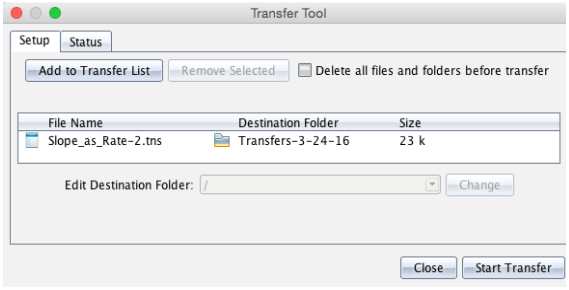
Step 8:

Locate a TI-Nspire™ document on your computer by browsing Computer Content in the Resources panel. Send the document by dragging and dropping it to the connected handheld. The document can also be sent by right-clicking it and selecting  **Send to Connected Handhelds**.



Step 9:

The Transfer Tool window appears with the current document. Documents can be added to or removed from the transfer list, and the destination folder on the handheld(s) can be edited or changed. To send the document to the handheld(s), click **Start Transfer**. Once the Status tab indicates that the transfer is complete, click **Stop Transfer**.



Inserting an Image into a TI-Nspire™ Document

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to use the TI-Nspire™ CX Teacher Software to insert images into the Graphs and Geometry applications. You will also learn how to move, resize, compress, and stretch an image, as well as make it appear more transparent.

Materials

- TI-Nspire™ CX or TI-Nspire™ CX CAS Teacher Software

Step 1:

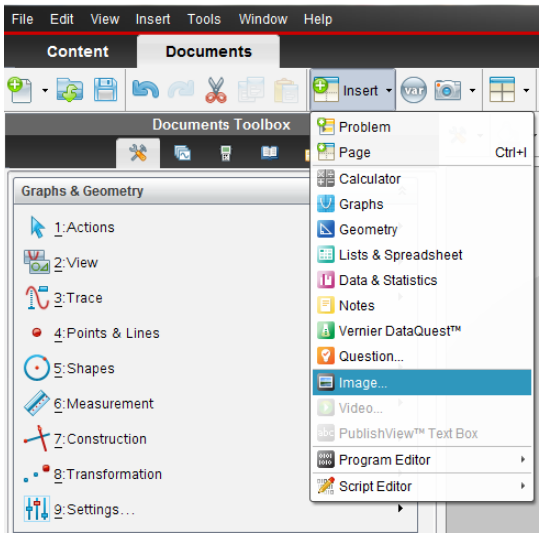
Open the Teacher Software. If the Welcome Screen appears when the software is opened, click to create a new document with a Graphs application as its first page. Otherwise, insert a Graphs application by selecting **Insert > Graphs**.

Note: Images can be inserted into Graphs, Geometry, Data & Statistics, Notes, and Question applications.

Step 2:

Insert an image into the Graphs application by selecting **Insert > Image**.

- A selection of images is preloaded in the **My Documents >TI-Nspire CX > Images** folder.
- Select **Ferris Wheel.png** and click Open.

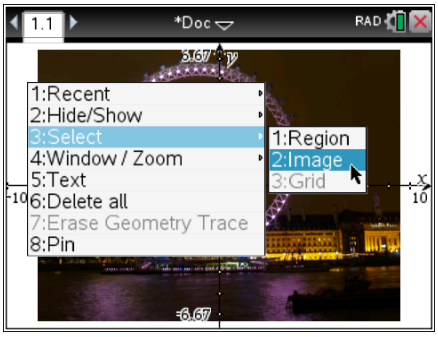


Note: Although the Teacher Software comes with a selection of preloaded images, all ***jpg***, ***jpeg***, ***bmp***, and ***png*** images are supported. The optimal format is .jpeg 560 × 240. Larger images may take the document longer to load on the handheld. Images appear in grayscale for TI-Nspire™ handhelds with Touchpads and Clickpads.

Inserting an Image into a TI-Nspire™ Document

TI PROFESSIONAL DEVELOPMENT

Step 3:

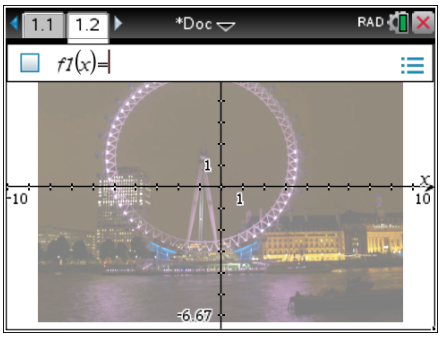


Images can be moved, resized, and vertically or horizontally stretched or compressed. To select an image in the Graphs, Geometry, or Question application, *right-click* on the image and choose **Select > Image**. To select an image in the Notes application, click the image.

- To move the image, grab and move the image.
- To resize the image, grab and move a corner – this action allows you to resize the image **and** maintain the aspect ratio.
- To vertically stretch or compress the image, grab and move the top or bottom edge.
- To horizontally stretch or compress the image, grab and move the left or right edge.

Note: To right-click an object on a handheld, press ctrl menu. To grab an object, press ctrl . To let go of an object, press esc.

Step 4:



To make an image appear more transparent, insert the image in a Geometry application, and then change the page to a Graphs application.

- Select **Insert > Geometry**.
- Then insert an image by selecting **Insert > Image**.
- Again, choose **Ferris Wheel.png**
- To change the Geometry application to a Graphs application, select **Menu > View > Graphing**.

Online Resources

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will explore resources available at education.ti.com. You will browse for activities at Math Nspired or Science Nspired. You will search for activities using the Standards Search and Textbook Search, and you will explore additional information regarding professional development.

Materials

- Computer with Internet connection

Step 1:

Go to **education.ti.com > Activities**. Select **Math Nspired** or **Science Nspired**, which can also be accessed directly at mathnspired.com and sciencenspired.com. Select a subject on the left.

Step 2:

Select a unit from the list. When a unit is selected, a table appears with an image from each activity. The table contains links to download, recommend, and save each activity. It also identifies each activity type:

Icon	Type	Description
	Bell Ringer	Bell ringers are short lessons designed to help transition quickly into class after the bell rings.
	Action Consequence Simulation	Interactive, engaging lessons allow students to perform actions on a mathematical object or scientific simulation, observe consequences, and make conjectures. Each lesson contains a pre-made TI-Nspire™ document, a Student Activity, and Teacher Notes.
	Create Your Own	In addition to the Student Activity and Teacher Notes, the lesson also includes step-by-step instructions on how to create the TI-Nspire document.
	Data Collection with Probes	Data Collection Labs give students the opportunity to collect and analyze real-world data with more than 50 data collection sensors from Vernier Software and Technology™.
	TI-Nspire™ Navigator™ Compatible	The Teacher Notes identify opportunities to use the TI-Nspire Navigator System, including opportunities for Quick Polls, Class Captures, and Live Presenter.

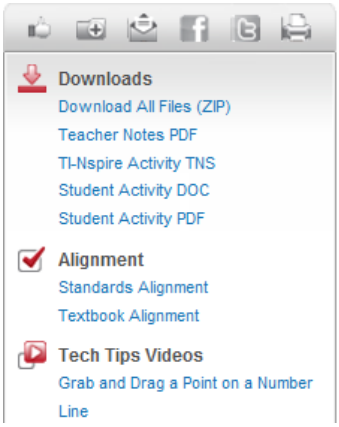
Online Resources

TI PROFESSIONAL DEVELOPMENT

Step 3:

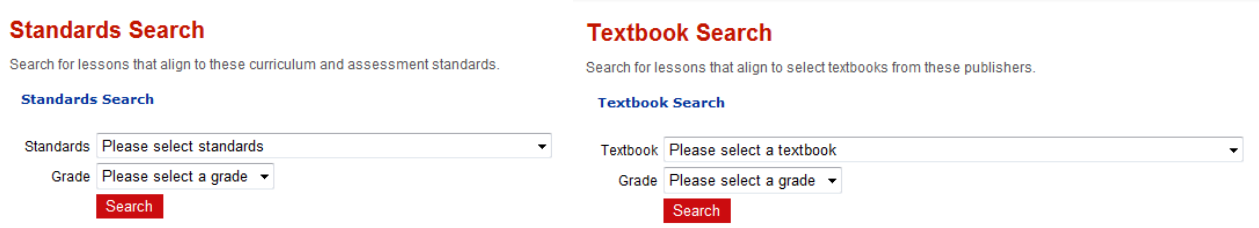
Select an activity from the list. The activity page shows objectives, relevant vocabulary, and additional information. A video offers a preview of the lesson, and related lessons are recommended below.

Icons above the Downloads section allow you to recommend, save, email, and print an activity. Links to Facebook® and Twitter® are also available. The Downloads section contains links to activity files. Links for Standards Alignment, Textbook Alignment, and relevant Tech Tip Videos are also available.



Step 4:

Explore the Standards and Textbook Search channels on the left. Select a set of standards or a textbook from the drop-down box, select a grade, and click **Search**.



Step 6:

Click the **Solutions** tab and select Common Core State Standards or Science Tools. Content and activities, technology resources, and information on professional development opportunities are provided.

Step 7:

Go to **Professional Development > Online Learning**.

The Tutorials page contains link to free Atomic Learning℠ video tutorials. There are video tutorials for the TI-Nspire™ handheld, the TI-Nspire™ software, the TI-Nspire™ Navigator™ System, and the TI-Nspire™ App for iPad®.

The Upcoming page contains links to upcoming, free PD webinars. The On-Demand page contains recordings of past webinars, and associated webinar documents are available for download.

Step 8:

Explore each of the following pages by clicking the appropriate tab: Products, Downloads, Activities, Professional Development, Solutions, Support, and Where to buy.

AP* Chemistry Lab Manual

A Guide to Using TI-Nspire™ for Data Collection and Analysis

After reading this guide, you will have a wealth of ideas about how you can use the TI-Nspire™ to collect and analyze data for the experiments in this AP Chemistry lab manual.

Data Collection – Getting Started

1. Decide what sensor(s) is(are) appropriate for your experiment. Most likely you will be using one or more of the following sensors in an AP Chemistry experiment: temperature, pH, conductivity, voltage, or colorimeter.
2. Choose the appropriate interface device (EasyTemp™, EasyLink™ cable, TI-Lab Cradle™) and attach it to the TI-Nspire™ handheld.

EasyTemp

EasyLink

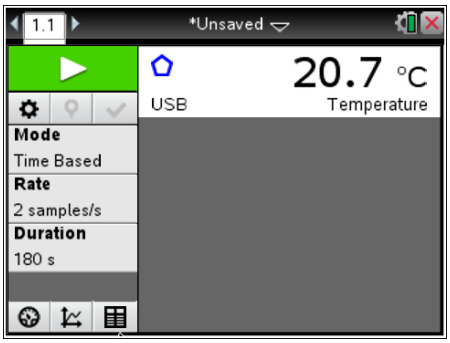
TI-Lab Cradle

3. Connect the sensor(s) to the interface device. (When using the Lab Cradle and only one sensor, it is best to plug the sensor into Channel 1.)
4. Launch the DataQuest™ application. (Note: In most cases the DataQuest application will launch automatically. If not, from the home screen on the TI-Nspire handheld, select **1** for **New Document** and then choose the DataQuest application from the applications available.)

Data Collection – How Do I Collect Data?

There are three main methods of data collection:

1. Use the meter window.
2. Perform a "Time Based" experiment.
3. Perform an "Events with Entry" experiment.



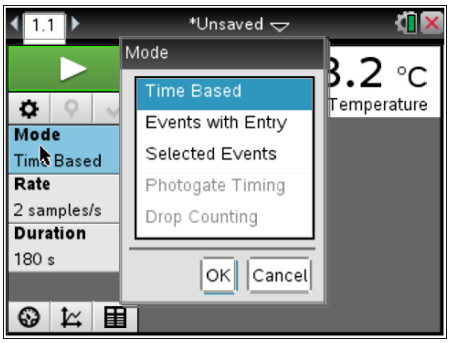
Using the Meter Window

There will be some experiments in which you will need to collect only one sample of data from a chemical substance or solution. For example, maybe you need to measure the conductivity of an ionic compound in solution. In that case, using the live readout of data in the meter window (shown above) is appropriate.

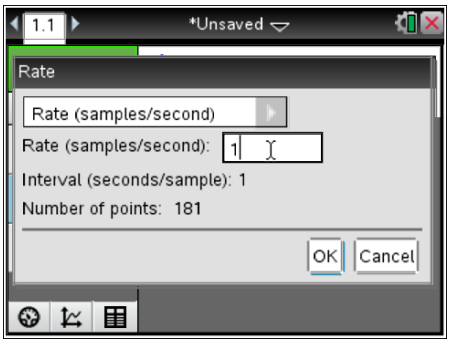
Performing a "Time-Based" Experiment

There will be some experiments in which you will want to study a variable over a certain period of time. For example, what if you were asked to determine the effect of the amount of water on the rate at which an effervescent tablet reacts in water? How would you set up the collection of data for that experiment? On the next page, you will learn about the various steps needed to carry out that process.

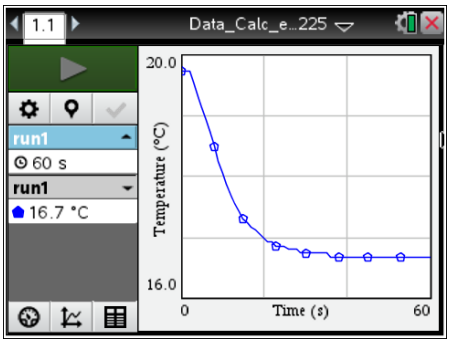
1. Be sure that the mode is set to "Time Based." (The fastest way to change the experiment mode is to click on the **Mode** area on the left side of the screen. Choose **Time Based**.



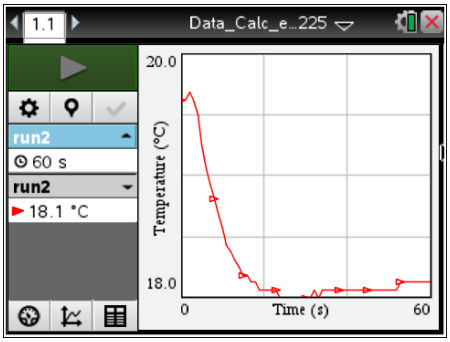
2. Now set up the parameters of how you will collect data in your experiment by clicking on the **Rate** and **Duration** areas on left. For example, in the effervescent tablet experiment, we might want to view the temperature changes over a 60-second period. The rate could be set to 1 sample/second and the duration set to 60 seconds. Click OK when you are finished.



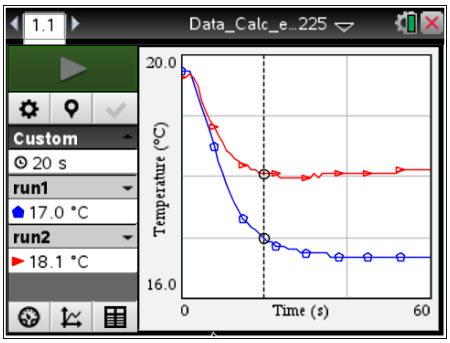
3. To begin the data collection, click the green **Start Collection**  arrow in the upper-left corner of the screen. Or press **Tab** until the start arrow is highlighted, then press **Enter** when ready. Once data collection begins, the Meter view switches to the Graph view and then the graph will autoscale when data collection is complete. *(The graph at the right shows how the temperature changes as a tablet is added to 50 mL of room temperature water.)*



4. If you are finished with the experiment, you can unplug the sensor; data is automatically saved. If not, press Store Latest Data Set  button to store the first run. Press **Enter** to collect a second run of data. *(The graph at the right shows run2: how the temperature changes as a new tablet is added to a new sample of 100 mL of room temperature water. Note how the scale automatically changed to fit the new data.)*



5. It is possible to see all of the runs that you collected at one time. Click on the current run at the left (**run2** in this case) and select **All.** Both runs of data will appear on the screen simultaneously, and you will be able to compare temperatures at a given time by clicking somewhere in the graph. A vertical line will appear and the **View Details** area will indicate the temperatures at that time.

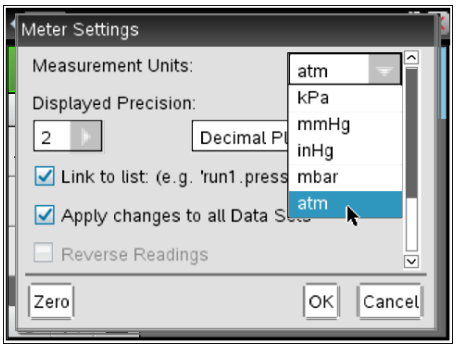


Later in this guide you will see how the TI-Nspire handheld can be used to analyze the data that you have collected in this mode.

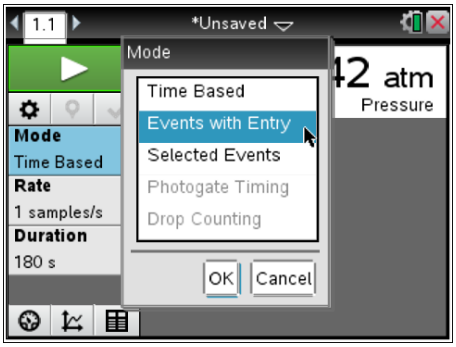
Performing an "Events with Entry" Experiment

There will be some experiments in which time is NOT an important factor when collecting data. You might want to collect data at one set of conditions and then under a different set of conditions. For example, what if you were interested in knowing the effect of changing the volume of a specific amount of gas on the pressure of that gas? It wouldn't really matter how long it took you to change a gas from 4 mL to 20 mL (in 2 mL increments) but you might want the TI-Nspire handheld to record the actual pressure at each volume. "Events with Entry" would be the mode that you would want to use. Below you will see step-by-step directions on how to collect data in this manner.

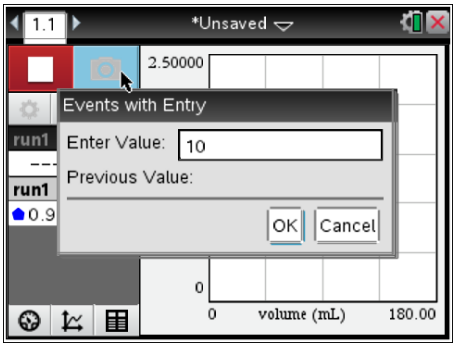
1. Before we set up the collection mode, it might be helpful to know that you can "click" in other areas of the screen as well. For example, in this experiment we might want to change the default units for pressure (kPa) to atmospheres (atm). Simply **click** on the reading window at the top, and select your preferred units from the drop-down menu. You can also click on the view buttons  ,  ,  , and areas such as **Mode**.



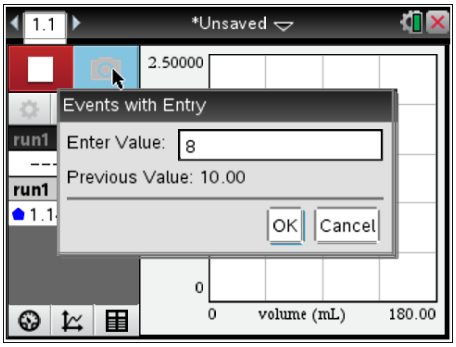
2. Okay, let's set up the data collection mode. Click on the **Mode** area at the left, and select Events with Entry. To name the event, click on the **Event Name** area that appears below Mode. The "event" is the variable that you are manipulating. Input the appropriate name and units of the event, and then click OK. In this case, we are changing the volume of 10 mL of air trapped in a plastic syringe. We will be studying the effect of changing this volume on the pressure of the gas.



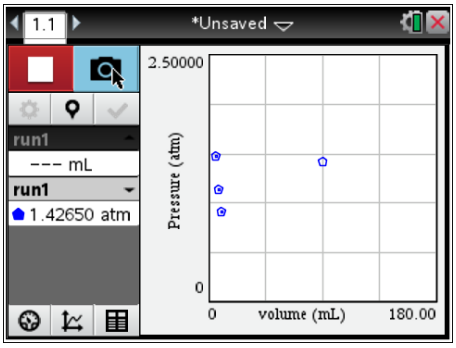
3. To begin data collection, click the green **Start Collection** arrow in the upper-left corner of the screen. Or press **Tab** until the start arrow is highlighted, then press **Enter** when ready. Once data collection begins, the Meter view switches to the Graph view. Notice that in this mode a new icon is visible. This is the **Keep** button, and it allows you to take a snapshot of the data when you are ready. *(The graph at the right shows what the screen looks like when the **Keep** button is pressed. The value of 10 is entered to represent the 10 mL of air trapped in the syringe.)*



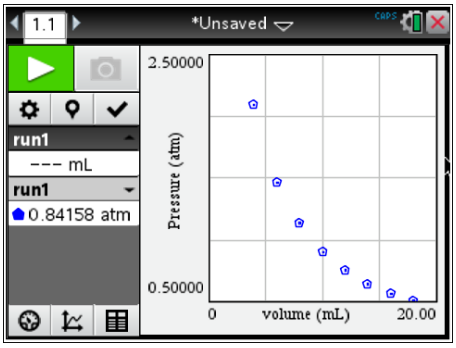
4. When you are ready to record data at a new set of conditions, press the **Keep** button again. *(Important: Do NOT press the **Stop** button!!! This is a common mistake made by new users. If you press **Stop**, you will need to start the entire experiment over again.)* Notice that when you press **Keep**, the window will remind you of the previous event value that you entered.



5. Continue collecting data until you are finished, and then press the **Stop** button. Notice that every time you enter a new event value, the screen returns to the graph view. It will display all of the data points that you have recorded plus the current event that you are about to record. *(The screen at the right shows blue dots for pressures recorded at 10 mL, 8 mL and 6 mL of volume. The "odd" point is the pressure of the air confined to 4 mL of space. The reason that it is in the center of the screen is that the **Keep** button has not yet been pressed and the value of 4 mL has not yet been entered.)*



6. You have now finished recording data in Events with Entry mode. Notice that the button in the upper left corner of the screen has returned to the **Start** button. *(The screen at the right shows all of the Pressure and Volume data for the original 10 mL sample of air.)*



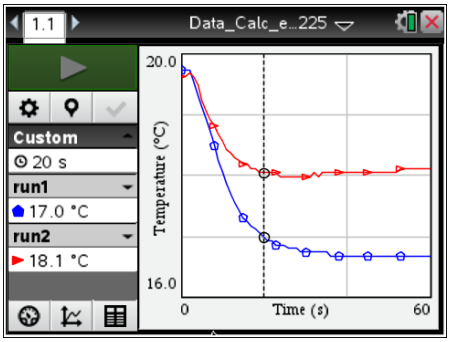
Later in this guide you will see how the TI-Nspire handheld can be used to analyze the data that you have collected in this mode.

Data Analysis

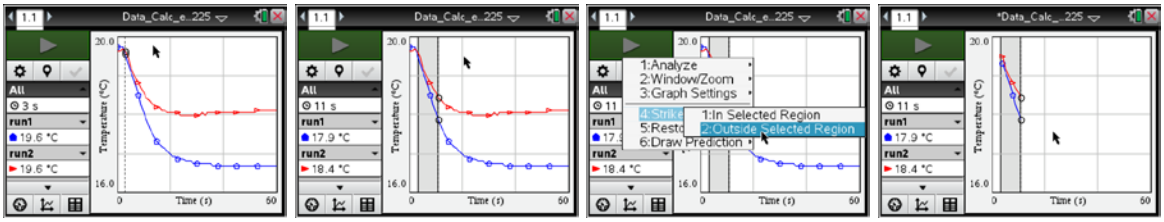
There are a few different tools available in the DataQuest application that make analysis of the data that you have collected quick and easy. Two important methods will be presented in this section.

Method 1: Striking Data

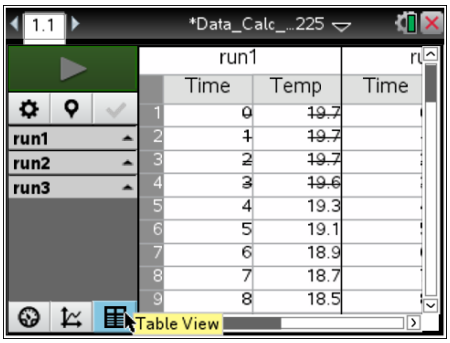
Remember the effervescent tablet experiment? Part of the graph looked very linear, and it might be interesting to know the slope of the two temperature curves in the early of the experiment. We could then compare the rate at which the temperature dropped in each situation (a tablet dropped in both 50 mL and 100 mL of room temperature water).

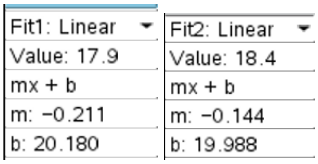


1. Click in the graph to create a vertical line. Click in the center of the touchpad for about 1 second until you see a double arrow appear on the line.
2. Let go of the center of the touchpad and run your finger lightly from left to right across the touchpad to select the area of the graph you would like to study.
3. Right click (**ctrl > Menu**) and select **Strike Data > Outside Selected Region**. When finished your graph will only show the portion of the data that you selected.



4. Don't worry. Your data is still there (as you can see from the Table view on the right). Striking data allows you to analyze just a portion of the data set without completing removing the information.
5. Return to Graph View. Now you are able to analyze each linear portion of the temperature graph to determine the different rates at which the temperature was dropping.
   - Select **Menu > Analyze > Curve Fit > Run1.Temperature** and press OK.
   - Select **Menu > Analyze > Curve Fit > Run2.Temperature** to see the other information. Now the rate information (the "m" values) can be compared in the View Details window at left for each graph.

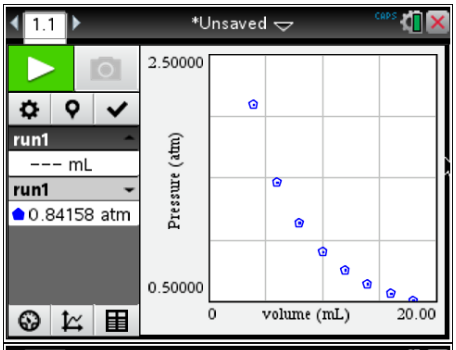


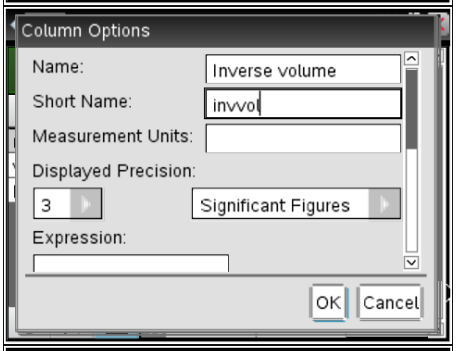


Method 2: Adding a Calculated Column in Table View

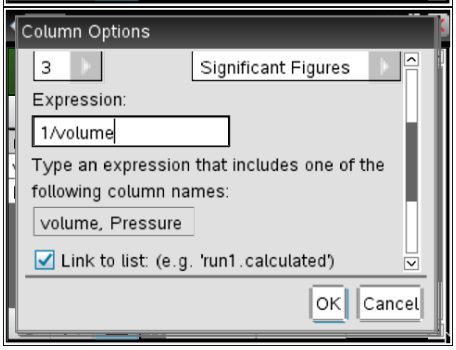
In the pressure/volume experiment, you'll recall that we created a curve of pressure versus volume values. To determine the equation of a graph, sometimes it is helpful to "linearize" the data. In this section, we will explore how a new calculated column of data can be added in Table View and how that new variable can be selected for study in Graph view.

1. Click on the Table View tab  . Then "right click" on the **View Details** area at the left; choose **New Calculated Column**.
2. Type in a name for the new column and any other fields that you find appropriate.

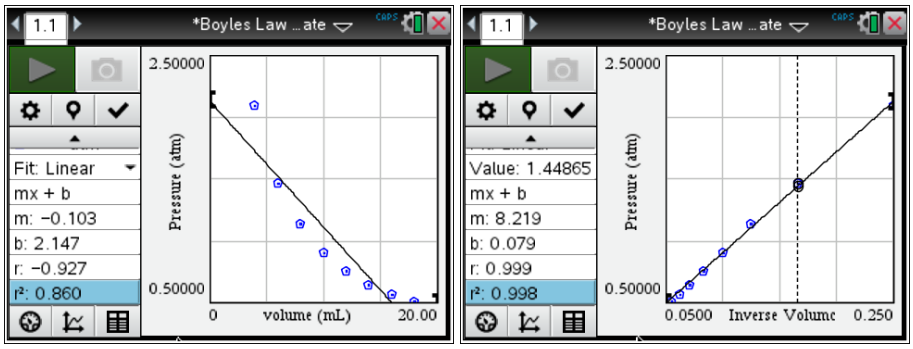




3. In the same window, scroll down to the **Expression** field. Enter the mathematical expression for the new column. (In this case, since it is possible to "linearize" the data by graphing Pressure vs. Inverse Volume, the expression entered is 1/volume.) When finished, click OK. The expression *variable* must match exactly the column name, including capital letters.



4. Click on the Graph view tab  to analyze the data. Press **Menu > Analyze > Curve Fit > Linear**. Obviously the data of pressure vs. volume do not fit the line created as is evidenced by the poor r^2 value of 0.860. (Data points with a good linear fit show an r^2 value close to 1.00.)
5. Click by the x-variable at the bottom of the graph (in this case, volume) and select the calculated column variable (inverse volume). The new graph is very linear. Redo the linear analysis. Here we see that Press = 8.219 * (1/Vol) + 0.079. (Remove the prior line with **Menu > Analyze > Remove**.)



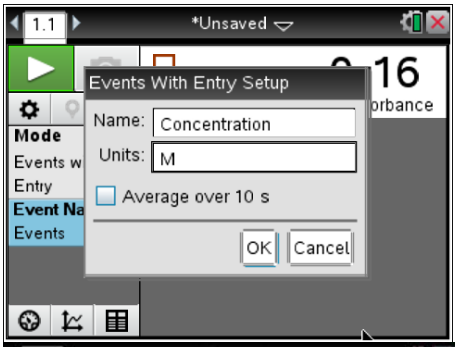
Data Collection and Analysis – Using the Colorimeter

The colorimeter (shown at right) is used to collect information about how much light of a certain wavelength is absorbed by a solution. This sensor uses Events with Entry mode but has a few extra steps involved to set it up for use.

The following procedure will highlight using the colorimeter to collect concentration and absorbance data using various solutions of green food coloring in water. First, data about four solutions of known concentration will be collected and then absorbance data of a solution of unknown concentration will be collected.

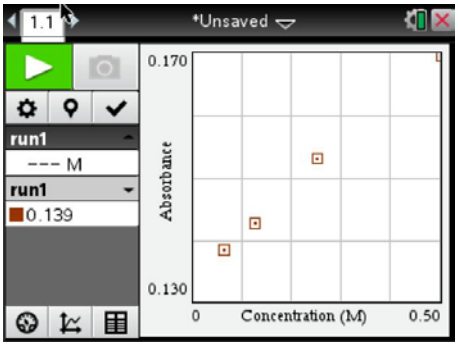
1. Connect the colorimeter to the TI-Nspire handheld using an EasyLink cable or a TI-Lab Cradle.
2. Select an appropriate wavelength of light to be used in the experiment by pressing the left or right arrows on the colorimeter. [You will want to use a different color other than the color of the solution. For example, if we passed green light (565 nm) through a green solution, most of it would be absorbed and we wouldn't see much difference in the data. An ideal color of light to pass through a green solution would be red (635 nm).]

3. Click on the **Mode** area at the left, and select **Events with Entry**. Click on the **Event Name** area, enter the variable name for the event (usually Concentration) and the appropriate units, and click OK.

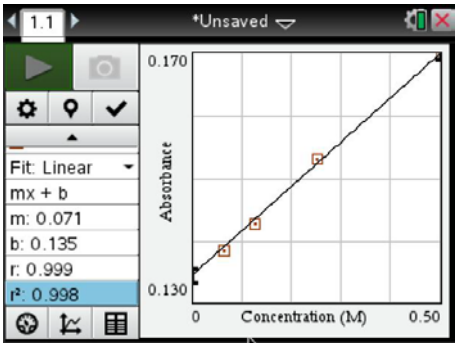


4. Now the device must be calibrated with the solvent being used in the solutions. Fill a plastic cuvette about ¾ full with the appropriate solvent (most likely this will be water) and place the cuvette in the holder inside the colorimeter. It is important that one of the smooth sides of the cuvette is pointed towards the white arrow at the top of the inside of the colorimeter. Also be sure that the smooth sides are free of oil or smudges from skin. Close the colorimeter door, and press the CAL button until the red light stops blinking. This will take about 5 seconds. The absorbance reading in the meter view should read 0.00.

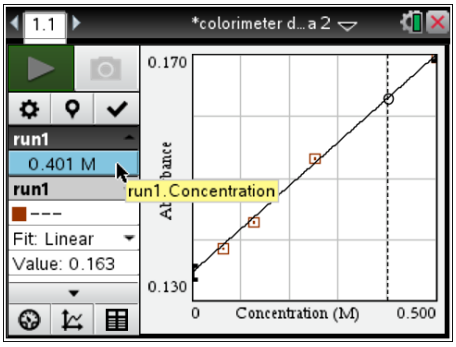
5. To begin data collection, click the green **Start Collection** arrow in the upper-left corner of the screen. Or press **Tab** until the start arrow is highlighted, and press **Enter** when ready. Replace the water cuvette with the first sample of known concentration being tested. Close the door, wait for the absorbance reading to stabilize, and then press **Keep**. Input the concentration of the known solution, and press **Enter**. Remove the first sample, replace it with the second sample, close the door, and press **Keep**. Repeat this process with the other samples of known concentration. When you are finished with all of the samples of known concentration, press **Stop**. *(The screen to the upper right shows absorbance readings for known solutions with concentrations of 0.500M, 0.250M, 0.125M and 0.0625M.)*



6. Find the best fit line through the data points. To do this, select **Menu > Analyze > Curve Fit > Linear**.



7. Put the sample of unknown concentration in the colorimeter, and close the door. Click Meter view ; note the absorbance reading once it stabilizes.
8. To determine the concentration at this absorbance, click Graph view . Then select **Menu > Analyze > Interpolate**. Click somewhere in the graph to see a vertical line.
   - Press the left or right side of the touchpad to move the line around on the graph. When you have moved the cursor to the appropriate place, the Fit Linear Value will correspond to the absorbance of the solution. You will then be able to read the concentration value at the top of the **View Details** window. (Note that in this example the unknown solution showed an absorbance of 0.163. The vertical line was moved into place until the Fit Linear Value was also 0.163. The concentration at this absorbance was 0.401 M.)



Note: To display the concentration at a higher precision, simply click on the concentration value as shown above and set the desired Display Precision in the pop-up window.

In Conclusion:

Hopefully, you have found the information in this appendix about how you can collect and analyze data using the TI-Nspire handheld to be helpful.

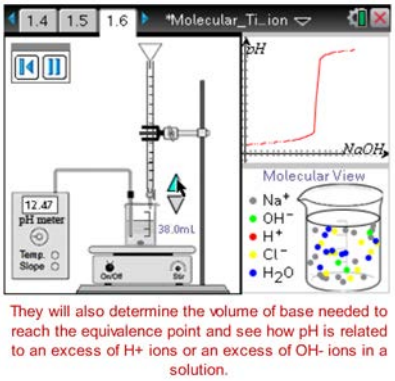
For further information about other applications within the TI-Nspire handheld, visit:

http://www.atomiclearning.com/k12/en/ti_nspire

For further information about the Vernier sensors that you will use with these experiments, visit:

http://www.vernier.com/products/sensors/

You might also want to visit the Science Nspired page on Texas Instruments' website (http://education.ti.com/calculators/tisciencenspired/) where you'll find some great simulations that can help you better understand concepts important to the AP Chemistry curriculum.



Example Shown: Molecular Titration Simulator

TI Technology Exam Acceptance

TI PROFESSIONAL DEVELOPMENT

TI-Nspire™ Technology

Approved for Tests	TI-Nspire™ CX TI-Nspire™ w/Touchpad TI-Nspire™ w/Clickpad	TI-Nspire™ CX CAS TI-Nspire™ CAS w/Touchpad TI-Nspire™ CAS w/Clickpad
SAT*	●	●
AP*	●	●
PSAT/NMSQT*	●	●
ACT*	●	
International Baccalaureate	●	
Praxis™	●	●
Texas STAAR® Grade 8	●	
Texas STAAR® Algebra	●	

Graphing Technology

Approved for Tests	TI-84 Plus CE TI-84 Plus C Silver Edition TI-84 Plus Silver Edition TI-84 Plus, TI-83 Plus	TI-89 Titanium
SAT*	●	●
AP*	●	●
PSAT/NMSQT*	●	●
ACT*	●	
International Baccalaureate	●	
Praxis™	●	●
Texas STAAR® Grade 8	●	
Texas STAAR® Algebra	●	

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