Title: ***Analog World, Digital World: Encoding and Transmitting Information***
Subject/Course: Waves and Their Applications in Technologies for Information Transfer
Topic: MS-PS4-3 Digital and Analog Signals
Grade 6
Designer: Teacher Annie Haven with Chatham Marconi Maritime Center Engineers

Stage 1—Desired Results

ANALOG WORLD, DIGITAL WORLD:
ENCODING AND TRANSMITTING INFORMATION

Day 1 Music Choice: Choose any song about the five senses from an online resource (e.g., YouTube)
Day 2 Music Choice: To make this more fun for the students, the teacher could play "Digital World" by Amaranthe. The song and video could be of interest to students in that the chorus states that living in the digital world allows people to never die and to never grow old. This could be an interesting conversation to have with students about information storage. The band is Scandinavian, and the music is not traditional pop, and it should catch the attention of the students because it is so different.
Days 3 and 4 Music Choice: Play your favorite song in your favorite format.
Day 5 Music Choice: "The Sound of Silence" by Simon and Garfunkel
Days 6 Music Choice: Your favorite Neil Young tune

Established Goals/Standards Based upon the National Academy of Sciences Frameworks and cited as follows:

National Research Council. (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.**)**

MA Draft Revised Science and Technology/Engineering Standards, December 2013

MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

MS-PS4-3 Present qualitative scientific and technical information to support the claim that digitized signals (sent as wave pulses representing 0s and 1s) can be used to encode and transmit information.

Scientific and Engineering Practices: Analyzing and Interpreting Data like an Engineer; Engaging in Argument from Evidence in Engineering

Understandings:	**Essential Questions:**
Both digital and analog devices are used in our society for a multitude of purposes including keeping time, measuring, and recording. Digital devices encode information by sampling the signal at intervals. The more samples that are taken, the higher the quality of the digital data.	How can we describe analog information? How do digitized devices encode and transmit information? What are the advantages and disadvantages of digital devices and analog devices?
Students will know . . . • Digitized signals are sent as wave pulses representing 0s and 1s. 0 is open circuit and off or low voltage. 1 is closed circuit and on or higher voltage. • Analog signals are continuous waves that vary with time. • Digital information takes samples of the continuous wave / analog wave, and it can be used to send information long distances.	*Students will be able to. . .* • Obtain, evaluate, and communicate information that allows them to argue the merits and limitations of analog and digital devices such as clocks, recording devices, and measurement tools.

Stage 2—Assessment Evidence

Performance Tasks (*Summary in G.R.A.S.P.S. Form*)

Goal: Students will argue the merits of digital and analog devices. Students will conclude that digital information can be more easily transmitted over long distances than analog information.

Role: User of digital and analog devices for a variety of tasks designed to illustrate advantages and disadvantages of both devices. Roles could include photographer to compare digital and analog photographs, time keeper, electrician, mechanical engineer measuring the width of metal cylinders, scientist measuring temperature, astronaut measuring mass, postal worker measuring a package to be sent, a music lover comparing records, tapes, and digital recordings. a person making a phone call to a friend using a landline phone (could be rotary or push button) and cell phone.

Audience: Peers and teachers

Situation: See roles above. Situation varies depending on equipment available for stations

Product/Performance: Students will construct arguments for or against the use of digital and analog devices for a variety of tasks. Performance assignment can be given as a pretest as well as a posttest.

Standards: See above for NGSS & MA standards and practices.

Materials

A variety of digital and analog devices used to accomplish similar tasks; for example, digital and analog clocks, photographs, volt meters, thermometers, scales, record player, tape deck, digital music player, rotary/ push-button/landline phone, cell phone, digital and analog micrometers.

Key Criteria for Evaluation

Use your district's persuasive writing rubric, or choose this one from Empowering Writers http://empoweringwriters.com/wp-content/uploads/2015/02/Opinion-Rubrics-TEKS-HI-RES.pdf .

Students will conclude that digital devices make information sharing easier because of the encoding and ability to transcend distance; however, analog devices can sometimes more accurately capture data without sampling. The more frequently the signal is sampled for digital, the more accurate the measurements will be. Students can argue in favor of digital for convenience and against digital for quality as long as the argument is backed by evidence.

Stage 3 - Learning Plan

Analog World, Digital World

DAY 1 LESSON - What is analog?

Prior Knowledge Question: What are your senses and how do they detect information?

Day 1 Focus - Students will analyze analog information, specifically how analog information is perceived, then challenged to reproduce that information so that it can be encoded and transmitted to someone else.

1. Pose prior knowledge questions to students as a think, then pair.
2. Ask students to identify one of their senses and imagine that they've received a signal. For example, they have heard a specific sound, felt something, seen a scene, smelled something, or tasted something. Give students a moment to choose their sense and what specific information is perceived.
3. Ask students to send/transmit that information to their partner. Ask students to be as precise and detailed as possible. For example, telling a partner that they hear a bird is not descriptive. Is it a chicken or a blue jay? How would the bird sound exactly?
4. Have students share out their partner's example. Be sure that all five senses have been explored as a class. If not, pose questions to the class as follows: How would you describe seeing the beach? How would you describe smelling a cookout? How does cold water feel? How does chocolate taste? How does your favorite person's voice sound?
5. Tell students that their senses are detecting analog information. It can be very difficult to encode and transmit analog information. Great writers struggle with this all of the time because it is difficult to describe sensations in words. They have to be very precise.
6. Ask students how they think the word "analogy" is related to the word "analog". Establish that analog information has to be transmitted or shared through analogies, such as, "the bird sounds like 'squak, squak" or "the cold water feels like a sting".
7. Now imagine you had to transmit information about length without a ruler, weight without a scale, temperature without a thermometer, time without a clock, or color without a color wheel. List these on a white board, projector system, or index cards. Ask students in their groups to consider how this would be accomplished.
8. Have the students share their thinking. Try to use the word "analogy" as often as possible. For example, length of an item would be transmitted through an analogy of a mark on a piece of paper or wood, weight could be made with an analogy of a pile of stones or a measure sand, temperature would be an analogy with ice or boiling water, time would be an analogy related to sunrise and sunset or the swing of a pendulum, and color would be a comparison with something else in nature. This is all analog information, and it is shared through analogies.
9. Now bring the class's attention back to sound. Ask students to recall that sound is a compression wave that starts with a vibration. If you have to describe a sound like a note (play a note on any instrument), how could you encode and transmit that information? You could recreate the sound with words and say them, use a microphone to encode and transmit through a PA system or telephone, use am or fm and transmit through a radio, or record it using a tapeing device or record, then hand deliver that to the receiver so they can decode it.
10. Print class copies of this information for students to read through as a class or have students read on devices. http://www.explainthatstuff.com/analog-and-digital.html . The reading level and examples are very age appropriate. Read all the way through and discuss where necessary. Be sure to read and discuss the bottom section, "What is Sampling?".

11. Distribute “Transmitting Information” graphic organizer (below). Discuss how the information is related. Double side the sheet so that the homework is on the back. Students will share this information tomorrow at the beginning of class.

DAY 2 LESSON – Understanding the Seven Segment Display On/Off/0/1

Prior Knowledge Questions: Refer students to their homework. What information would they choose to share? How would they encode and transmit the information? What device could they use to quantify that information (example: ruler, scale, thermometer, etc.).

Day 2 Focus - Developing an understanding of the clock as a device that can be analog or digital and that the digital clock uses the 0/1/off/on code.

1. First, pose prior knowledge questions to students as a Think, Pair, Share. Have pairs report and record information in a mind map on the board.
2. Tell students that today they are going to be learning about digital and analog devices that tell time. Have students contribute to a conversation about when they have to do something "on time", why they think we have time zones, and what they think defines standard time. Show this hook video: https://www.youtube.com/watch?v=SjlasIEbrXg for information about the establishment of standard time. Establish the importance of a standard of measurement and using a standard set of numbers to share information. The encoder and decoder both need to understand the standard of measurement and the standard set of numbers. (Remind students of this video if it has been used in class https://www.youtube.com/watch?v=ZMByI4s-D-Y as related to mass and the standard kilogram).
3. Display two clocks: one analog and one digital. Establish that both devices use electricity or batteries to operate. Show this link, which is a simple study of analog and digital clocks. Be sure to click on the digital and analog clock animation and try it. https://www.mathsisfun.com/time-clocks.html
4. Explain that in the case of the analog clock, the gears inside run continuously and measure continuous time. Many digital clocks, such as the one on your phone, are programmed to change the time once every sixty seconds. It does this by turning on and off the seven parts of the digital display. This is known as the SSD, or seven segment display.
5. Explain to the students that they are going to learn how digital devices use 0s and 1s to create a code for off and on. This "off and on" code is the basis for digital information.
6. Show and provide students with copies of the Seven Segment Display Reference Sheet (attached below; double side it with the homework thinksheet). Discuss how the codes work. Display a Seven Segment Display device. Show students how to apply the codes to the device. If time allows, have students work in small groups for five minutes to manipulate the times on digital clock or stopwatch devices.
7. Have students choose one digit, then record the "off and on" code on an index card. Shuffle the cards and redistribute them. Using their reference sheets, students decode their digit. This would be their Ticket to Leave. Everyone with the digit 6 may dismiss, everyone with the digit 5 may dismiss, etc. Teacher must collect and check cards as students exit. This understanding is the first step towards understanding that 0s and 1s represent the "off and on" code that encodes a digitized signal.
8. Homework Thinksheet: Seven Segment Display (attached below).

DAYS 3 AND 4 LESSONS - Analog and Digital Lab Stations

Prior Knowledge Questions: What kinds of scientists can you name, and what are some examples of measuring devices those scientists may use?

Day 3/4 Focus (May take two days depending on the number of stations) - Comparing analog and digital devices based on tasks to be accomplished

1. Activate Background Knowledge: Ask students to compare how analog and digital information is encoded. Be sure students verbalize that analog measurements are continuous and digital information samples analog information and encodes it using the "off and on" code of 0s and 1s.
2. Explain each of the stations and the lab data sheet (attached below) to students. Working in small groups, students will rotate through the stations collecting data about each task. Sample tasks are:

*You are a scientist in Alaska studying the spring ice melt. Graph the temperature of the sea water over time as the ice melts (use ice in salt water for this task).

*You are a photographer. Study the analog and digital cameras. Your task is to decide how you will take the photographs, how you will send the photographs to a friend or family member living in another state, and how the quality of two photographs compares.

*You are the timekeeper of a Pee Wee football game. Each quarter is to be five minutes in length. Use both devices to measure the quarters.

*You are an electrical toy engineer. Measure the voltage of the batteries to power the toy to see if it is enough for the toy to function properly.

*You are a mechanical engineer designing a water pumping system for a golf course. The water company has provided you with a variety of options for pipes. You need to find the one that can be most easily connected to the nozzle of a hose. Measure the available pipe diameters using the micrometers and choose the one closest to the hose so that a coupling can be created.

*You are an astronaut measuring the mass of moon rock samples. Collect and report that data.

*You are a postal worker measuring the mass of packages. Find out how much it will cost to mail the different packages and letters.

*You enjoy listening to music. You have many options for purchasing music. Listen to each device and decide for yourself which format is your favorite and why.

*You are a nurse at Urgent Care. You must weigh each of the patients as they come into the office. Collect that data and report it to the doctor in another part of the building.

*You are phoning three friends to invite them to a sleepover party you are having this weekend. Using the devices available to you, time how long it would take you to accomplish that task.

3. At the end of class, students are assigned to use the data collected in today's lab to prepare an argument for or against the music industry's reliance on digital recording practices. Students will share their arguments tomorrow in class and base their opinions on specific examples from their lab station data.

DAY 5 LESSON - Graphing digital data for sound waves

Prior knowledge questions: Why do we graph information in science class? What does it mean to interpolate data? When we interpolate data, we start with fixed points on a graph. We then estimate the points in between. This is how we interpolate data.

Day 5 Focus - Graphing and interpolating digital data for sound waves

1. Activate Background Knowledge: Ask students to compare how analog and digital information is encoded. Be sure students verbalize that analog measurements are continuous and digital information samples analog information and encodes it using the "off and on" code of 0s and 1s.
2. Remind students of the video clips that displayed how graphing is used to show analog and digital sounds. Explain that today, they will graph part of a sound wave so that they can have a visual representation of analog recording and digital sampling. This graph will be used in their final arguments in one of two ways. First, students could argue in favor of analog over digital because the digital signal is not continuous and therefore leaves out information. In contrast, students could argue in favor of digital over analog because the digital sampling could be taken at such a high rate that the information left out is so minimal a human could not hear the difference.
3. Complete "Graphing Sound Waves" worksheet below. If necessary, use the first two pages of this site to provide more background knowledge for the students or for students who may be struggling with the concept: http://courses.me.berkeley.edu/ME102B/Past_Proj/f03/Proj6/TMS320LF2407A_Documents/Intro-ADC.pdf .

DAY 6 LESSON - Digital and Analog Music Recording Debate

Prior Knowledge Questions: Activate prior knowledge by asking students what kind of clock woke them up for school that morning (analog, digital, or a living person/pet/internal). Ask the students who woke up to digital and analog clocks what they noticed about their particular devices (colored display, hands, etc.) or if they thought about the code used inside their digital and analog clocks. Next, ask where else besides their alarm clocks they saw evidence of the seven segment displays. Finally, ask students if they have seen the 0/1 switch anywhere else in their lives. (Some copiers, overhead projectors, computers, and printers have it as the on/off switch, so point this out on any devices available in the classroom).

Day 6 Focus - Introducing the Digital VERSUS Analog Music Recording Debate

1. Ask students to volunteer information about what kinds of devices they use for listening to music and why. Establish that many people use digital devices because they make it easy to purchase and store music. If possible, display tape/ record/CD/8 track cases or photographs of people's music collections.
2. Ask students to compare their experience with live music to recordings of that music, if possible. This could include any live music performance including their own music classes.
3. Ask students if they know how people historically listened to music (photograph, music box, live, records, tapes, 8 track, etc.).
4. Using at least two different devices (one analog, one digital), play a song for the students. Discuss the merits of each.
5. Explain that there are a number of professional musicians today who debate between analog and digital music recording. Neil Young, the legendary musician, is one of them, as is Jack White of the White Stripes. However, what is the difference? Play this clip from Mr. Audio to explain how analog and digital music looks graphically in wave form: https://www.youtube.com/watch?v=SfEXnX__X9Y .
6. Play this Youtube clip of MTV News from 1993 about how musicians and listeners have reacted to the switch from analog to digital recording. https://www.youtube.com/watch?v=kR7227_ndqQ Pause the video wherever necessary to clarify information about the digital encoding and graphs of analog and digital. Ask students what they think of the fact that their digital music leaves out some of the musical information because it is just a sample and not a continuous wave.
7. Ask students if they know what AutoTune is or if they recognize it in music. Ask them if they think musicians have a responsibility to be real and talented, or if they should just be able to make themselves sound good in the studio by making digital changes. Play this video, which explains and highlights the debate: https://www.youtube.com/watch?v=HGiaAiIELME . Once you have watched this video, have students listen to their music to see if the songs they enjoy show evidence of Autotune. Now that I personally know how to listen for Autotune, I hear it frequently in songs on the radio.
8. Ask students what they would do if they were a musician who was concerned that digital recordings of their music was leaving out sound information. Then, as a class, read this article http://2machines.com/164549/ about Mr. Young's dedication to Pono, a new music format superior to MP3.
9. Explain to students that there are advantages and disadvantages to digital and analog information. Tomorrow, students will be working at stations using various analog and digital devices to accomplish tasks. This information gathering will then be used to argue in favor or against the use of recording artists using digital or analog.
10. Homework Thinksheet: Assign students to learn more about the analog/digital audio debate and complete the thinksheet (attached below).

Extensions: Extensions are built into homework thinksheets below.

Resources / Internet Links:

Stemscopes has Digital vs. Analog Signals information if your school has access.

https://learn.sparkfun.com/tutorials/analog-vs-digital has both simplified information as well as extensions. There are a great number of links from this page that can be used for educators and students.

http://www.brown.edu/Departments/Engineering/Courses/En123/Lectures/DAconv.htm is a collegiate interpretation of analog and digital conversion exercises.

http://courses.me.berkeley.edu/ME102B/Past_Proj/f03/Proj6/TMS320LF2407A_Documents/Intro-ADC.pdf is an excellent resource for understanding the graphing and sampling of analog and digital information. The first two pages should be reviewed by the teacher before doing the graphing. It can also be used to show students sampling error or to help students who are struggling.

http://www.gcat.org.uk/blog/?tag=sound-recording is an excellent site about graphing and sampling.

https://www.youtube.com/watch?v=XCu6L4kQF3k could be a summarizer video (just be careful of the spelling issues of the creator!) about benefits of digital.

Transmitting Information

Present qualitative scientific and technical information to support the claim that digitized signals (sent as save pulses representing 0's and 1's) can be used to encode and transmit information.

Information (Message)	Encode	Transmit
Analog: Sound Length Weight Temperature Time Color		
Sound	Words	Speech
	Microphone	PA system Telephone
	AM/FM modulation	Radio
	Record on record or tape	Hand deliver
Digital: Digital display	Words Binary Code	
Sample analog signal	CD code	Hand deliver
Create list of numbers	Binary code	Internet

NAME: _____ **DATE:** _____ **BLOCK:** _____

Analog World / Digital World Day 1 Homework: Transmitting Information

Directions: Choose something to measure such as weight, temperature, size, or quantity. Describe what it is you are trying to measure and use analogies to convey that information. You may not use a measuring device, but describe the device that you would use if you could.

1. Draw a picture of what you would like to measure.

2. Describe what it is you are trying to measure in words.

3. Now you will encode your measurement using letters and words. Use analogies to convey your measurement. Ex. It is as warm as ___.

4. Describe the measuring device you would use if you could for this task.

5. You need to share your measurement with another person. Who is that person, where are they located, and how will you transmit the information to them?

NAME: _____ DATE: _____ BLOCK: _____

SEVEN SEGMENT DISPLAY REFERENCE SHEET

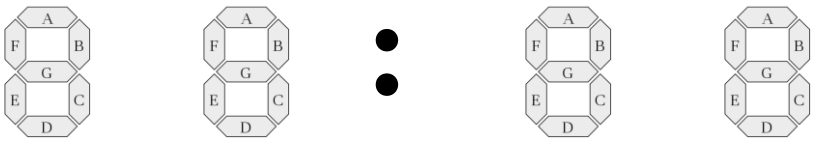
1. **Draw and label the seven segment display here:**

Are the letters arranged clockwise or counterclockwise?

2. **Reference Image:** http://forum.allaboutcircuits.com/threads/bcd-to-7-segment-display.52779/

Binary Inputs				Decoder Outputs							7-Segment Display Outputs
D	C	B	A	a	b	c	d	e	f	g	
0	0	0	**0**	1	1	1	1	1	1	0	0
0	0	0	**1**	0	1	1	0	0	0	0	**1**
0	0	**1**	0	1	1	0	1	1	0	1	**2**
0	0	1	1	1	1	1	1	0	0	1	3
0	**1**	0	0	0	1	1	0	0	1	1	**4**
0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	0	1	1	1	1	1	6
0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	0	1	1	1	1	1	1	1	**8**
1	0	0	1	1	1	1	1	0	1	1	9

3. Color the digits of the clock below to show your favorite time of day.



4. Now, write the code for each of the digits using the 0/1/off/on code.

First digit:

Second digit:

Third digit:

Fourth digit:

NAME: _____ DATE: _____ BLOCK: _____

SEVEN SEGMENT DISPLAY HOMEWORK THINKSHEET

1. **Where do you see seven segment displays in your house? List as many specific devices as you are able using bullet points.**

2. **Color the digits of the clock below to show what time you eat dinner.**

:

3. **Now, write the code for each of the digits using the 0/1/off/on code.**

First digit:
Second digit:
Third digit:
Fourth digit:

4. **Curious? Here are some ideas about how you can spend time on your mind!**

   A. Research the 10,000 year clock, great gravity clock in FL, al-Jazari's clocks (castle water and elephant) and share your research to the class in any manner of your choice.
   B. Research how time is related to space travel, quantum physics, string theory, etc. See our video from class today for more information: https://www.youtube.com/watch?v=SjlasIEbrXg .
   C. Research and practice binary code and binary counting. Share your learning with our class!

NAME: _____ DATE: _____ BLOCK: _____

MUSIC INDUSTRY DEBATE: DIGITAL VERSUS ANALOG HOMEWORK THINKSHEET

Directions: Watch each of the videos and comment in the spaces below.

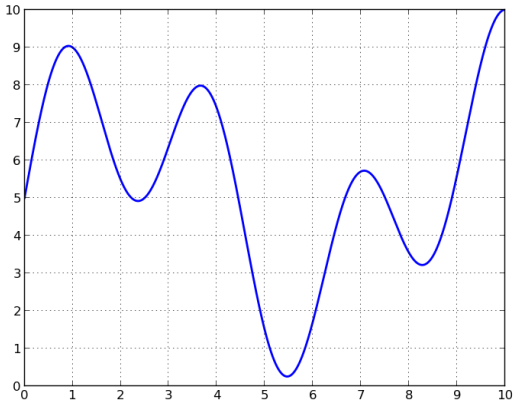
1. https://www.youtube.com/watch?v=D2quieLxCE0 shows you a test of digital versus analog as experienced by one guitarist. Take at least three bullet point notes about what you hear and what you think. What is your opinion by the end of the video?

2. https://www.youtube.com/watch?v=jJZPKJcZG-Y is Grandmaster Flash talking about the transition of hiphop in the 1970s transitioning from analog to digital. Take at least three bullet point notes about what you hear and what you think. What is your opinion by the end of the video?

NAME: _____ **DATE:** _____ **BLOCK:** _____

ANALOG WORLD, DIGITAL WORLD GRAPHING

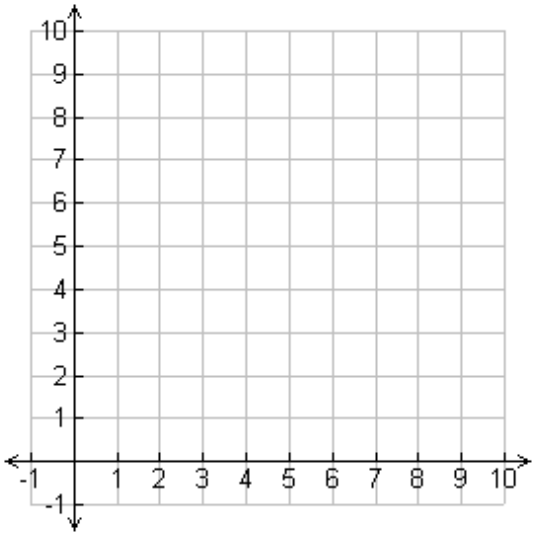
1. **This is an analog recording of a sound wave from** http://www.gcat.org.uk/blog/?tag=sound-recording **. Label the x- and y- axes.** (Interestingly, according to quora.com, *axes* is the only word in English that can be the plural of three different singular noun forms--*ax*, *axe*, and *axis*.)



2. **Now, record the data points as whole numbers based on the x-axis.**

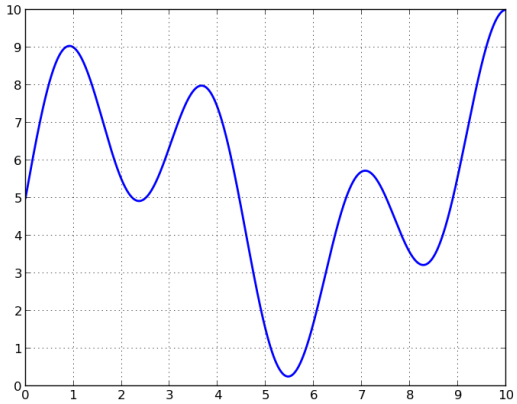
0, __	3, __	6, __	9, __
1, __	4, __	7, __	10, __
2, __	5, __	8, __	

3. **Now, graph the data points you just recorded and connect the points.**



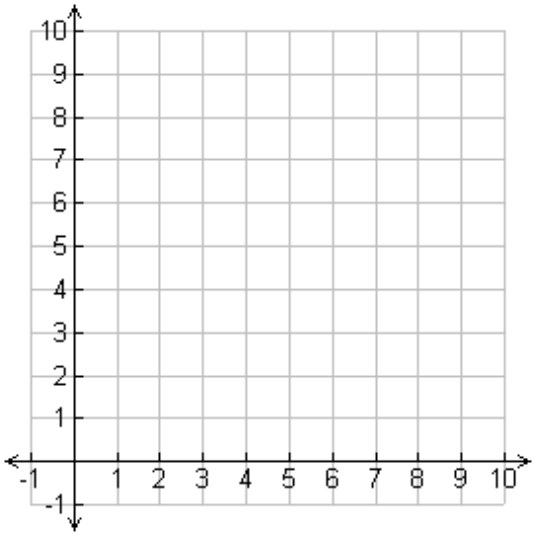
4. **Compare the graphs. What do you notice?**

5. **Now you will take a sampling at a higher rate (X2). Look at the original graph and record the data points every ½ unit based on the x-axis.**



0, __	2, __	4, __	6, __	8, __	10, __
.5, __	2.5, __	4.5, __	6.5, __	8.5, __	
1, __	3, __	5, __	7, __	9, __	
1.5, __	3.5, __	5.5, __	7.5, __	9.5,__	

6. **Now, graph the data points you just recorded and connect the points.**



7. **Compare the graph you just made to your first graph. What do you notice?**

8. **Do you think that you could take a frequent enough sample that a graph of the points would look close to the original analog graph? Explain why or why not.**

_____
_____
_____
_____
_____
_____
_____
_____

9. **How could your graphs be used to argue that analog recordings are more accurate than digital recordings?**

_____
_____
_____
_____
_____
_____
_____
_____

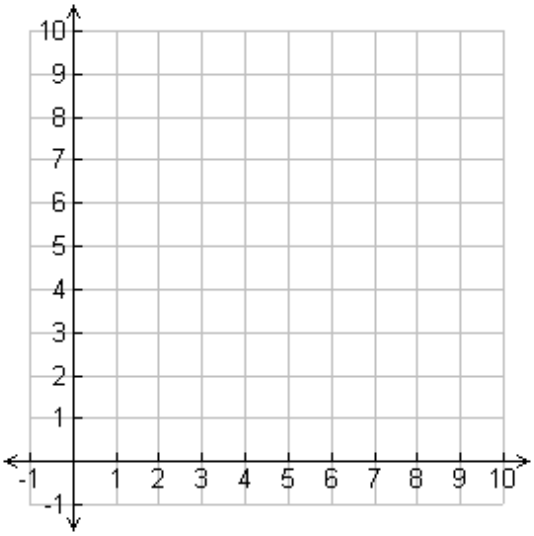
10. **How could your graphs be used to argue that digital sampling could be just as accurate as an analog recording?**

_____
_____
_____
_____
_____
_____
_____
_____

11. **Is there anything else you are wondering or about which you are curious?**

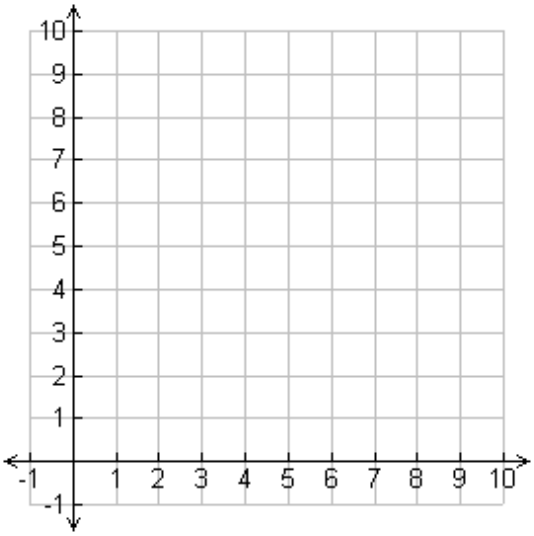
ANALOG WORLD, DIGITAL WORLD GRAPHING HOMEWORK

1. **Draw a sound wave on the graph below.**



2. **Trade this paper with a partner. Record your partner's name here:**
3. **Partner, record the data points in the space below:**

4. **Partner, graph the data points on this graph.**



Together, compare the original graph to the partner's graph. What do you notice?

NAME: _____ **DATE:** _____ **BLOCK:** _____

ANALOG WORLD, DIGITAL WORLD

Directions: Each lab station requires you to perform a task using the available analog and digital devices. For each station, gather data to complete the chart below.

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

Pros of Each Device:
Cons of Each Device:

Task:	Devices:	Results:

NAME: _____ DATE: _____ BLOCK: _____

MUSIC INDUSTRY DEBATE: DIGITAL VERSUS ANALOG

My choice as a recording artist is...

Directions: Using evidence from the data you gathered graphing the sound wave, at the lab stations, and your understanding of digital and analog information, consider the following scenario: you are a recording artist and must choose a format for your music. Your producer is arguing for the opposite of what you want. How do you convince your producer to allow you to record in your desired format? Do you choose digital or analog? Why? You must support your argument to your producer with evidence.

Use this space to brainstorm, organize your argument, and create an outline. As you write, refer to your persuasive writing rubric.

LESSON EVALUATION FORM 3-1-2012

Lesson Title Duration of Lesson Date

Grade Level #Students Teacher(s)

1. Did you conduct the entire lesson?	Yes	No
2. Was the lesson plan clear and easy to follow?	Yes	No
3. Did the lesson meet your academic objectives?	Yes	No
4. Was the lesson age appropriate?	Yes	No
5. Was allotted time sufficient to conduct lesson components?	Yes	No
6. Did the activity support the lesson?	Yes	No
7. Did the students have the prior knowledge needed for the lesson?	Yes	No
8. Did the lesson create discussion and questions among students?	Yes	No
9. Were the students interested and motivated?	Yes	No
10. Did the lesson provide for differentiated instruction?	Yes	No
11. Was the knowledge content age appropriate?	Yes	No
12. Would you use the lesson again?	Yes	No
13. Did materials allow all students to be involved?	Yes	No
14. Were the materials durable and appropriate?	Yes	No

How would you rate the lesson success overall (excellent, good, fair, poor)?

How would your students rate the lesson overall (excellent, good, fair, poor)?

What would make the lesson more useful to you?

COMMENTS ON POSSIBLE REVISIONS TO MAKE LESSON MORE EFFECTIVE: