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UNDER PRESSURE

TEACHER'S GUIDE

East Bay Municipal Utility District

2/16/2018

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COVER SHEET

UNDER PRESSURE

<u>Coversheet for Instructors</u>

Introduction: The following material introduces students to computations involving percent and volume.

Materials:

Projector connected to a computer with internet to show video for the lesson

Copies of each of the following:

- Warm-up and Exit Ticket
- Under Pressure worksheet

Prior Knowledge/Skills Needed: see details below

Before this application lesson, students must be able to:

-Compute volume of a cylinder

-Apply percentage concepts

-Apply conversions

Water distribution operators must be able to view the level of water in their water tanks (commonly known as reservoirs) on their computer screens. The way water levels are determined, is by measuring the pressure at the bottom of the tank, and then converting that number (which is given in PSI, pounds per square inch) to a height.

Water levels are critically important for water management organizations because the utility is required to maintain a certain amount of water in reservoirs at all times. In case of a sudden large demand for water, greater than can be provided instantaneously, (as in the case of fire or even at times of day when consumers are using a lot of water simultaneously, like morning showers) the water district might need to provide additional volume beyond what is considered normal.

Instrument technicians are required to verify the accuracy of their measuring devices from time to time. The measurement readings must be reliable, in order for distribution operators to know exactly how much water is available.

Here are some terms and mathematical concepts that must be understood before a student can solve a problem involving water levels and instrumentation readings.

Volume: In this context we will be talking about the volume of a reservoir or water storage tank that is cylindrical in shape.

The volume of a cylinder is: $\pi r^2 h$ (where 'r' is the radius of the reservoir and 'h' is the height.) Make sure units are consistent. If radius is measured in feet, height should also be measured in feet.

Percent: General ability to apply percent concepts.

Conversion: 7.48 gallons of water = 1 cubic ft.

PSI (pounds per square inch)

1 PSI is defined as 27.7 inches of water. (the diameter of the container of water is not a factor) This is a reading of pressure exerted on the bottom of the tank by the water in it.

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WARM-UP EXERCISE

UNDER PRESSURE

Warm-Up:

1) If a tank that measures 120 inches in height is 65% full, how many inches of water does it contain? Express your answer two ways: in inches as well as in feet.

2) The volume of a cylindrical water tank is 3500 cu. ft.

a. How many gallons of water can it hold at full capacity?

b. What is the tank's diameter if the height is 10 ft?

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VIDEO

“Under Pressure” Video

May 11, 2016

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WORKSHEET

Problem pertaining to Fire Sciences/Water Pressure – “Under Pressure”

<u>Background</u>

Water distribution operators must be able to view the level of water in their water tanks (commonly known as reservoirs) on their computer screens. The way water levels are determined, is by measuring the pressure at the bottom of the tank, and then converting that number (which is given in PSI, pounds per square inch) to a height.

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Contextualized Math problem

Assume a water tank has a height of 300 inches, and a diameter of 30 feet. When full, the tank will have a pressure of 300 inches of water. At the 50% level, this tank would have a pressure reading of 150 inches of water.

A water distribution operator's computer screen shows one of his 300-inch reservoirs is 75% full.

1) How many inches of water should we measure at the bottom of the reservoir?

2) How many feet of water?

3) How many PSI?

We know that the reservoir is 300 inches tall with a diameter of 30 feet.

4) What is the maximum capacity (in gallons) of the reservoir?

5) If the reservoir is 75% full, how many gallons are in it?

The level indicator on the side of the reservoir reads 25% full. There is a gauge at the bottom of the tank, which reads 5.1 PSI.

6) Is the gauge reading accurately?

7) If not, what should the gauge the reading?

Answers to Math questions:

1) 225 inches (.75 x 300)
2) 18.75 ft. (225 ÷ 12)
3) 8.12 PSI (225÷27.7)
4) 132,182.4 gallons {first find volume ($\pi r^2 h$), then convert to gallons}
5) 99,136.8 gallons {.75 x 132,182.4}
6) No
7) If gauge reads 5.1 PSI that suggests a water height of 141.27 inches. (5.1 x 27.7) But if this reservoir is only 25% full and it is 300" tall, then it has a water height of 75 inches, which converts to 2.71 PSI.

Warm-up:

1) If a tank that measures 120 inches in height is 65% full, how many inches of water does it contain? Express you answer two ways: in inches as well as in feet.

2) The volume of a cylindrical water tank is 3500 cu. ft.

a. How many gallons of water can it hold at full capacity?

b. What is the tank diameter if the height is 10 ft?

Exit Ticket:

1) In your own words described what you learned today.

2) How difficult did you find this problem?

3) What part of the problem was most difficult for you?

* Different from a naturally occurring reservoir?

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SOLUTION SHEET

UNDER PRESSURE

Solution Sheet

1) 225 inches (.75 x 300)
2) 18.75 ft. (225 ÷ 12)
3) 8.12 PSI (225÷27.7)
4) 132,182.4 gallons {first find volume ($\pi r^2 h$), then convert to gallons}
5) 99,136.8 gallons {.75 x 132,182.4}
6) No
7) If gauge reads 5.1 PSI that suggests a water height of 141.27 inches. (5.1 x 27.7) But if this reservoir is only 25% full and it is 300" tall, then it has a water height of 75 inches, which converts to 2.71 PSI.

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EXIT TICKET

UNDER PRESSURE

Exit Ticket:

1) In your own words described what you learned today. Try to use some of the technical terminology you heard in the video.

2) How difficult did you find this problem?

3) What part of the problem was most difficult for you?

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TEACHER'S FEEDBACK FORM

Feedback Form for Teachers (Online)

Online Version of Feedback Form:
https://goo.gl/forms/esHz2B0pokGqqSWP2

Feedback Form for Teachers

I. Information on Teacher and the Module Used

Name of Teacher

Date Module was Used

Name of Class in which module was used

Number of students in class

Name of school or other organization

Name of the Contextualized Learning Module Used

II. Components of the Contextualized Learning Module Used

Yes	No	
☐	☐	A. The Problem Illustration Video
☐	☐	B. The Warm-Up Ticket
☐	☐	C. The Cover Sheet
☐	☐	D. The Solution Sheet
☐	☐	E. The Exit Tickets
☐	☐	F. Videos of individual Subject Matter Experts
☐	☐	G. Feedback form for students

III. Feedback on components of the module

A. The Problem Illustration Video

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?

4. Not applicable—this component of the module was not used

B. The Warm-Up Ticket

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

C. The Cover Sheet

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

D. The Solution Sheet

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

E. The Exit Tickets

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

F. Videos of individual Subject Matter Experts

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

G. Feedback form for students

1. What did you think worked in this component of the module?
2. What did you think didn't work as well?
3. Do you have any suggestion for how we could make this component of the module more effective in future modules?
4. Not applicable—this component of the module was not used

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STUDENTS FEEDBACK FORM

Feedback Form for Students (Online)

Go here for the Online Version of Feedback Form:
https://goo.gl/forms/3vSjzMuzFDuxY1y73

Feedback Form for Students

Please rate each of the following aspects of this lesson:

	Excellent	Very Good	Good	Fair	Poor	Very Poor
1. Video						
2. Lesson Presentation						
3. Worksheet						
4. Time Allotted						

5. What aspect or part of this lesson do you believe was the most effective at helping you reach the learning goal?

6. Where would you have wanted more training or help on this?

7. Did this curriculum increase your awareness of the water/wastewater industry?

8. Additional Comments/Suggestions:

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SCRIPT

"The Kyle and Lyle Show"
EBMUD Tank Level Instrument Tech Video

By

BAYWORK for the Contextualized Learning Project

www.baywork.org

VIDEO	AUDIO
INTRODUCTION: Briones Reservoir (Bear Creek Road) Show service area map while Lyle is describing the service area	LYLE HERNANDEZ KYLE TERRY LYLE HERNANDEZ Hi, my name is Lyle Hernandez. I’m an instrument technician at EBMUD. KYLE TERRY Hey, my name is Kyle Terry. I’m an instrument worker III at EBMUD. We help to provide high quality drinking water for 1.3 million east bay residents. LYLE HERNANDEZ Our service area encompasses a 331 square mile area from Crockett in the north, south to San Lorenzo, east to Walnut Creek, and south from Walnut Creek to San Ramon. KYLE TERRY We use math on a daily basis in the various jobs we’re required to perform. LYLE HERNANDEZ Next, we’d like to show you an example of what one of these jobs would look like.
SCENE 1 - AMC INSTRUMENT OFFICE: Kyle looking at work order program on computer screen at desk. Kyle’s phone rings. Cut to Lyle looking at the same work order program.	KYLE TERRY Kyle Terry, East Bay MUD. LYLE HERNANDEZ What’s up Kyle? KYLE TERRY What’s going on Lyle? LYLE HERNANDEZ The control center says the foot gauge doesn’t match the level transmitter at Berkeley View Reservoir.

VIDEO	AUDIO
Zoom out revealing Kyle and Lyle are right next to each other. Kyle and Lyle fist-bump and both say together "Pronto!"	KYLE TERRY Alright! Let’s get on it, pronto! LYLE HERNANDEZ Pronto? KYLE TERRY Pronto.
SCENE 2 - AMC PARKING LOT: Quick cut shots of tools stacking up into van, van doors closing, engine starting.	
SCENE 2A - 21 STREET, RIGHT OUTSIDE AMC GATE: van pulling out from AMC and taking off down 21st Street.	
SCENE 3 - BERKELEY VIEW RESERVOIR: van pulling up. Kyle and Lyle exit van and gather tools and equipment.	LYLE HERNANDEZ Kyle, what is the foot gauge reading? KYLE TERRY 12.5 feet LYLE HERNANDEZ Humm, the transmitter is reading 100 inches, that’s just a little over 9 feet, off by at least a foot!

VIDEO	AUDIO
SCENE 4 - PIT CALIBRATION: Kyle comes down to pit where Lyle is working.	KYLE TERRY Here it says it hasn’t been calibrated in over 2 years. Let’s perform a calibration check on the transmitter.
Lyle and Kyle perform calibration check.	LYLE HERNANDEZ Give me zero percent. KYLE TERRY ok, here’s zero. LYLE HERNANDEZ Nice, perfedct zero. Give me 50 percent now. KYLE TERRY How tall is the tank? LYLE HERNANDEZ It’s 22 feet when full. KYLE TERRY Alright. Here’s 132 inches, 50 percent. LYLE HERNANDEZ Great. I’m reading 50 percent. Now let’s try 100 percent. KYLE TERRY Ok. I’m sending you 100 percent now. LYLE HERNANDEZ Ok, the transmitter seems top be working perfectly. The problem must be the gauge. KYLE TERRY Let’s adjust it to match the level transmitter and call the control room. LYLE HERNANDEZ Sounds good!

VIDEO	AUDIO
ENDING - BRIONES RESERVOIR:	
	<u>KYLE TERRY</u> Thank you for watching our video! <u>LYLE HERNANDEZ</u> If you’d like to know more about careers in water and wastewater, visit the baywork website.
Pan of Briones Reservoir. End.	

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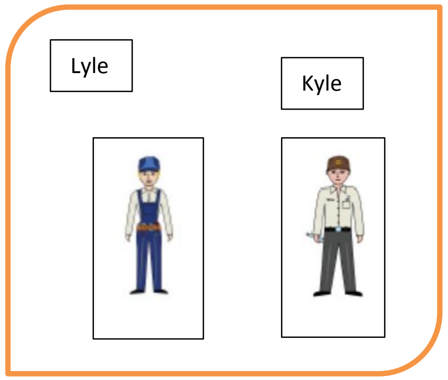
STORYBOARD

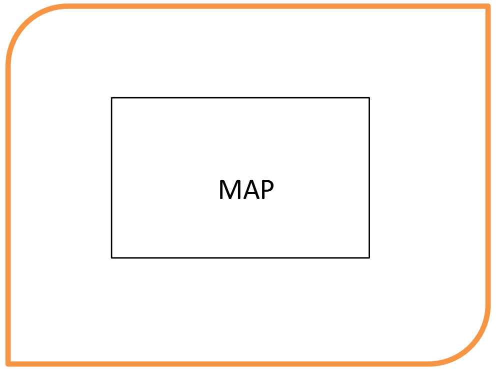
Project Name: Tank Level Video – EBMUD

Date: 4/11/2016

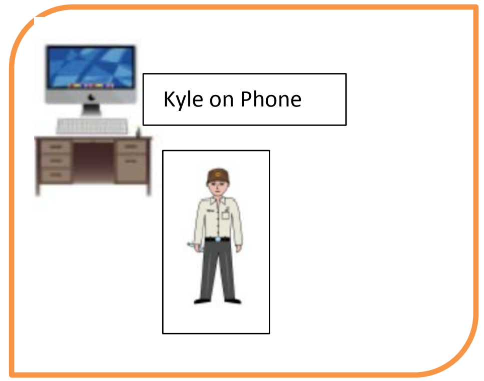
Intros – Briones Reservoir



Service Area Map Photo/Video



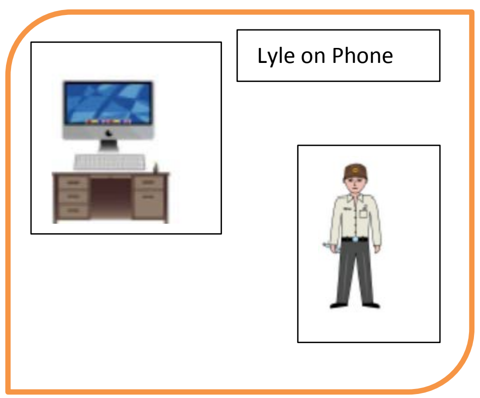
Scene 1 – AMC Office – Close-Up of Kyle



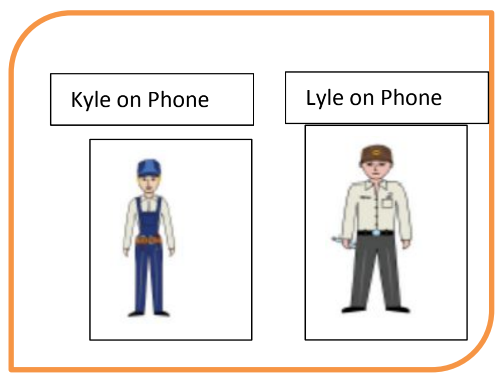
Scene 1a – AMC Office – Close-Up of Lyle

Scene 1b – "What's going on Lyle?" Close-Up

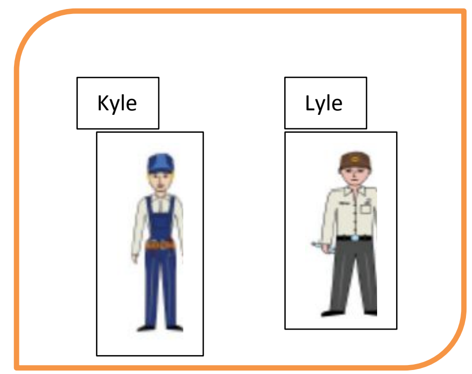
Scene 1c –…in Berkeley View Reservoir." Close-Up



Scene 1d –Zoom Out to see that they are both in the same room. Medium Shot



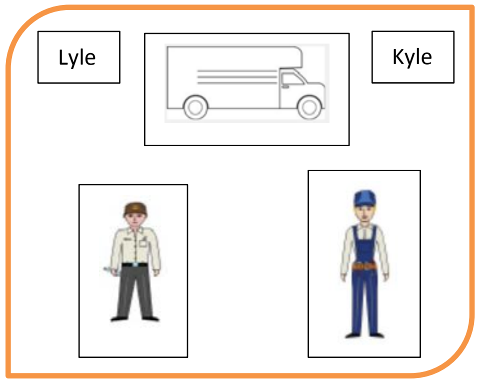
Scene 1 e –Fist-Bump. Medium Shot



Project Name: Tank Level Video – EBMUD

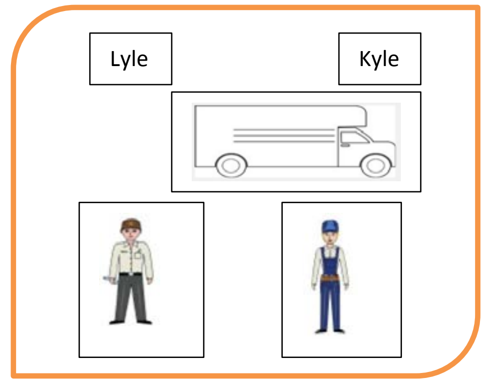
Date: 4/11/2016

Scene 2 –21st Street – K and L pack tools in van, engine starts

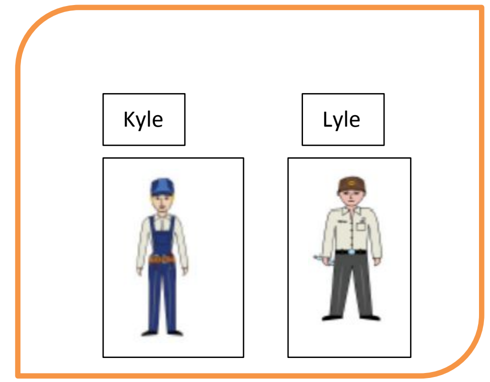


Scene2a –Van drives away

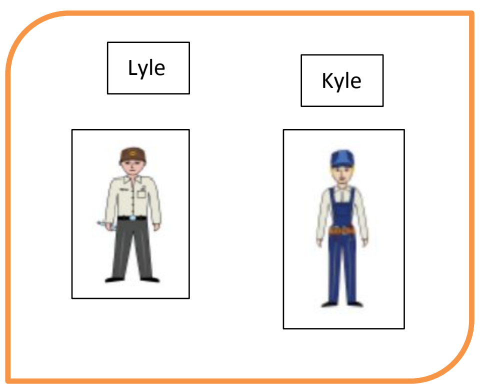
Scene 3– Berkeley Reservoir. Van pulls up, K & L take out tools



Scene 3a– Berkeley Reservoir, K & L take measurements



Scene 4 – Berkeley Reservoir, K & L - Pit Calibration



ENDING – Briones Reservoir Pan, K & L talk about their jobs and the baywork website