Lab Template

Text:
Volume: Financial Algebra **Chapter:** Prepare a Budget
Unit number: 10-1 **Title of unit:** Utility Expenses
Developed by *(Include contact information)*: **DeAnn Dige**
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Date: June 27, 2012

Attach the Following Documents:

1. **Lab Instructions**
2. **Student Handout(s)**
3. **Rubric and/or Assessment Tool**

Short Description (Be sure to include where in your unit this lab takes place):

Students will find out the cost of using common household electrical equipment. This lab will be completed at the end of the unit of instruction.

Utilities Cost Lab

LAB PLAN

TEACHER: *(Teacher Prep/Lab Plan)*

- **Lab Objective**
- Compute the cost of using specific appliances for specific lengths of time. See attached document for guidelines.

- **Statement of prerequisite skills needed** *(Vocabulary, Measurement Techniques, Formulas, etc.)*
  - Percentage, multiplication, and division skills

- **Vocabulary**
  - Utility
  - Watt
  - Watt-hour
  - Kilowatt-hour (kWh)

- **State Standards addressed:** *(Highlight "Green" Standards, you may use your District's Power Standards if applicable)*

  Math:
  - Reason quantitatively and use units to solve problems – Use units as a way to understand problems and to guide the solution of multi-step problems;

choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays
- Reason quantitatively and use units to solve problems – Define appropriate qualities for the purpose of descriptive modeling
- Interpret the structure of expressions – Interpret parts of expression, such as terms, factors, and coefficients
- Interpret the structure of expression – Interpret complicated expressions by viewing one or more of their parts as a single entity

Reading:
- Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

Writing:
- None relevant

Leadership:
- The student will be involved in activities that require applying theory, problem-solving, and using critical and creative thinking skills while understanding outcomes of related decisions

- **SCAN Skills/Workplace Skills:**
- Basic Skills
  - Locates, understands, and interprets written information prose and documents – including manuals, graphs and schedules – to perform tasks
  - Identifies relevant details, facts, and specifications
  - Writing
    - Communicates thoughts, ideas, information, and messages in writing
    - Records information completely and accurately
  - Arithmetic
    - Performs basic computations
    - Uses tables, graphs, diagrams, and charts to obtain or convey quantities information
- Thinking Skills
  - Decision Making
    - Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative
  - Knowing How to Learn
    - Recognizes and can use learning techniques to apply and adapt new knowledge and skills both in familiar and changing situations
  - Reasoning
    - Discovers a rule or principle underlying the relationship between two or more objects that applies it in solving a problem
- Personal Qualities
  - Responsibility
    - Exerts a high level of effort and perseverance towards goal attainment
  - Sociability
    - Responds appropriately as the situation requires

- Self-Management
  - Is a "self-starter"
- **Teacher Preparation:** *(What materials and set-up are required for this lesson?)*
  - Materials: Paper or electronic copy of Utilities Cost Lab worksheet
  - Set-Up Required: None

- **Lab Organizational Strategies:**
  - Grouping/Leadership/Presentation Opportunities: None – individual activity
  - Cooperative Learning: None – individual activity
  - Expectations: Students will identify 5 commonly used household electronic items then determine watts used, convert to kWh, then calculate the amount used per month. Based on this information can determine monthly use
  - Time-line: 1 class period at the conclusion of the presentation of the unit

- **Post Lab Follow-Up/Conclusions** *(to be covered after student completes lab)*
  - Discuss real world application of learning from lab: Students will be able to determine the cost of using common household items. The awareness will help to create options for saving money
  - Career Applications:
    - When living independently or as part of a family, the financial resources available will be limited, so understanding how money is spent and ways that costs can be reduced are vital in maintaining a budget.
    - Financial planner, business owner/operator, accountant, accounts payable clerk, homeowner, building custodian/maintenance
  - Optional or Extension Activities: None related to the lab

Utilities Cost Lab

Name _____

Select 5 different items ***you*** typically use in your home on a daily basis, ie. Cell phone charger, hair dryer, flat iron, computer, toaster… Using the internet, find out the following information about your item

Electrically Powered Item	Average monthly kWh (may need to convert from single use watts to monthly kWh, estimate amount of time used per day then multiply by 30)	Cost of electricity per kWh for your area	Cost per month

How can you reduce the amount of power used on just one item?
By how much could the cost be reduced?
What is the net/overall savings for that item?


UTILITIES EXPENSES

What Do You Think?

- Types of Expenses?
  -
  -
  -
  -
  -
  -
  -

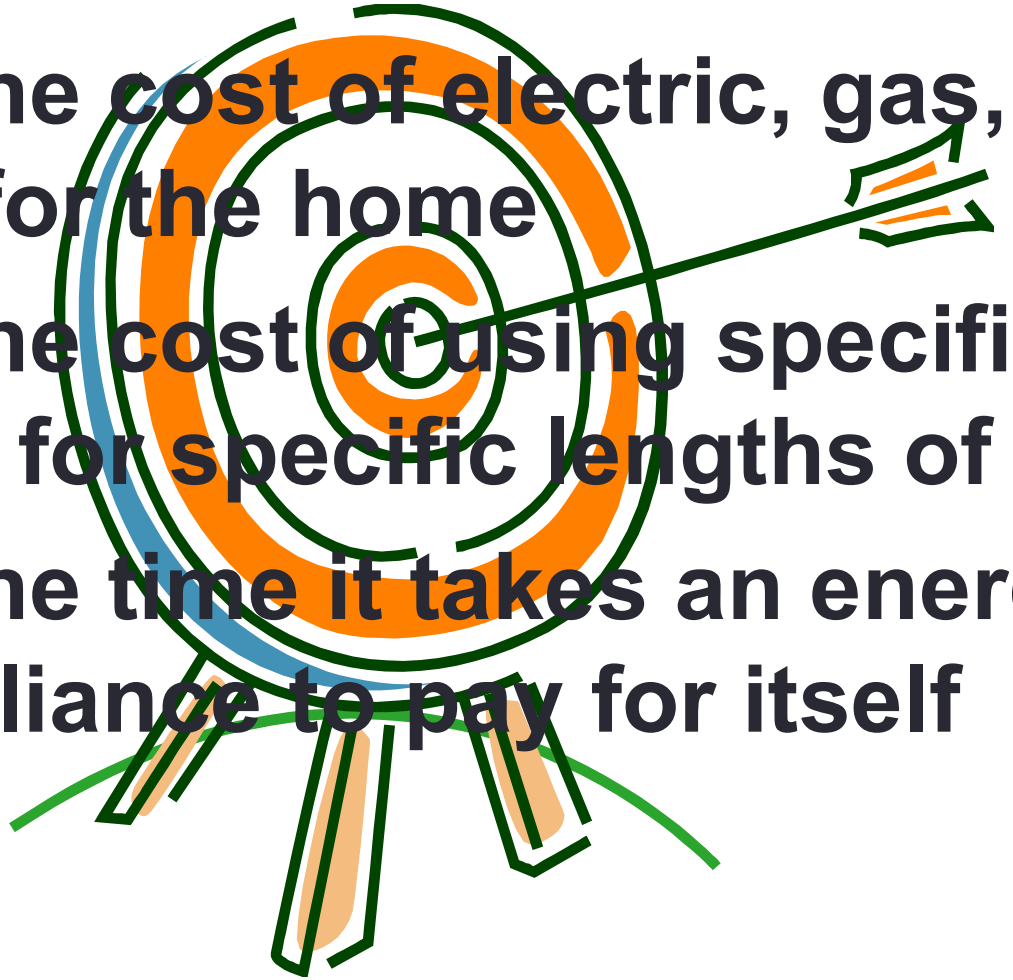
BUDGET

- Budget (n) – spending and savings plan
  - I need to keep within my household budget.
- Budget (v) – allocate money to certain spending categories
  - My wife and I budget $100 per month for entertainment.
- Budget (adj) – something that is reasonably priced
  - He bought a budget suit.

Budgeting Can Help You Save Big Bucks!!

Learning Targets

- **Compute the cost of electric, gas, oil, and water for the home**
- **Compute the cost of using specific appliances for specific lengths of time**
- **Compute the time it takes an energy-saving appliance to pay for itself**



Key Terms

- Utility – Expenses for electricity, natural gas, heating oil, and water that are incurred while living at home
  - Typically paid after you use them – using credit when you purchase utilities
- Meter – A device that records how much of a particular utility is used
- Watt – A unit of measure used to electricity

- Watt-hour – A unit for the usage of electricity
  - For example – a 60-watt light bulb burning for two hours uses 120 watt-hours
- Kilowatt-hour (kWh) – A unit of measure by which electricity is sold; equivalent to 1,000 watt-hours of electrical use
- Cubic foot – A unit of measure by which natural gas and water are sold; it represents the amount of space occupied, not the weight

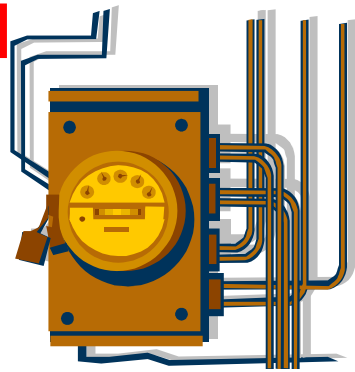
- Ccf – a unit of measure that represents 100 cubic feet
- Volume – the amount of space inside a three-dimensional region, such as a room; volume is measure in cubic units
- Previous Reading – the reading as of the last time the meter was read
- Present Reading – the current meter reading

How Much Will It Cost to Run the Utilities in Your Home?

- Tom's October water bill listed two meter readings. The previous reading was 3,128 ccf and the present reading is 3,141 ccf. How much water did Tom's household use during the billing period?

SOLUTION

- Subtract to find the number of ccf of water used.
- 3,141 – 3, 128 = 13
- **Tom's household used 13 ccf of water during the billing period**



Reading Utility Meters

- Janet works for a utility company and is reading the Saevitz household's electric meter. What is the reading?

  - HINT: Notice where the arrow points on each dial. The correct reading is the lower of the two numbers closest to the arrow, with one exception. If the arrow points between 0 and 9, this is read as 9.
- This meter shows a reading of 833 kWh of electricity

Appliance Usage - Example

- An electric mixer requires 125 watts. How much would it cost to run the mixer of a total of 90 minutes at a cost of $0.10 per kilowatt-hour?
- Solution: Calculate the operating cost of an electrical appliance by checking its wattage and the time it is being used.

- Convert minutes to hours
  - 90 minutes = 90/60 hour = 1.5 hours
- The number of watt-hours is the product of the watts and the number of hours the appliance is in use
  - 125 x 1.5 = 187.5 watt hours
- Electric usage is billed by the kilowatt-hour, which is 1,000 watt-hours. To express the 187.5 watt-hours, divide by 1,000
  - 187.5 watt-hours = 187.5/1,000 = 0.1875 kWh
- Cost per kWh = $0.10
  - 0.1875 x 0.10 = $0.01875
- **The mixer cost 1.9 cents to use for 90 minutes**

Variables to Utility Usage – Climate/Seasons

- Summer – air conditioning – increase electricity use
- Winter – heat – increase oil/gas usage
- Balanced billing – evens out cost of utilities
- Last year, the Ross family spent $3,336 for electricity. They are opting to use balanced billing for next year. What will their monthly payment be?

Solution

- Balanced billing uses previous year (historical data) to determine monthly payments for the upcoming year.
  - Annual utility cost / 12 months per year
  - 3,336 / 12 = 278
- **The Ross's monthly electric bill will be $278 under the balanced billing program**

Energy Efficiency = Saving $$$

- Old water heater = $455/year to run
- New one = purchase cost $1,240 with 31% annual savings on energy costs
- How many years will it pay for itself?

Solution

- Compute the savings per year by finding 31% of $455
  - $455 x 0.31 = $141.50
- Divide the cost of the new appliance by the annual savings in energy
  - 1240 / 141.50 = 8.791
- **The water heater will pay for itself in about 9 years, since it will take more than 8 years to save more than $1,240**

Exit Slip

- Choose one to complete
  - I still have questions about…
  - Something new I learned was…
  - I will be able to use this information…

UTILITY EXPENSES – Problem Quiz

Name _____

1. Caleb's last water bill listed a previous reading of 8,312 and a present reading of 8, 377ccf. His water company charges $0.83 per ccf of water. What should Caleb have been charge on his last water bill?

2. What is the meter reading, in ccf, indicated by the gas meter?

3. Home heating oil is sold by the gallon. Last winter, the Campbell family used 395 gallons of oil at a price of $4.02 per gallon. If the price increases by 11% next year, what will their approximate heating expense be? Round to the nearest ten dollars.

4. Last winter, Andrew was charged $953.82 for 9,513 kWh of electricity. What did his company charge per kilowatt-hour of electricity?

5. Last year, the Lewis family spent $1,773.65 for electricity. They are opting to use balanced billing for next year. What will their monthly payment be under balanced billing?

6. The Alanez's old refrigerator costs them $545 per year to run. The new one they purchased for $1,420 will save them 31% annually in energy costs to run. In how many years will it pay for itself?

7. In December 1995, the average cost for 1 gallon of home heating oil in Atlantic City, New Jersey was $1.133 per gallon. By December 2009, it had risen to $4.713 per gallon. What was the percent increase in those 14 years? Round to the nearest percent.

UTILITY EXPENSES – Problem Quiz - Answers

Name _____

1. Caleb's last water bill listed a previous reading of 8,312 and a present reading of 8, 377ccf. His water company charges $0.83 per ccf of water. What should Caleb have been charge on his last water bill? $53.95

2. What is the meter reading, in ccf, indicated by the gas meter? 83,736

3. Home heating oil is sold by the gallon. Last winter, the Campbell family used 395 gallons of oil at a price of $4.02 per gallon. If the price increases by 11% next year, what will their approximate heating expense be? Round to the nearest ten dollars. $1,760

4. Last winter, Andrew was charged $953.82 for 9,513 kWh of electricity. What did his company charge per kilowatt-hour of electricity? $0.10

5. Last year, the Lewis family spent $1,773.65 for electricity. They are opting to use balanced billing for next year. What will their monthly payment be under balanced billing? $147.80

6. The Alanez's old refrigerator costs them $545 per year to run. The new one they purchased for $1,420 will save them 31% annually in energy costs to run. In how many years will it pay for itself? About 9 years

7. In December 1995, the average cost for 1 gallon of home heating oil in Atlantic City, New Jersey was $1.133 per gallon. By December 2009, it had risen to $4.713 per gallon. What was the percent increase in those 14 years? Round to the nearest percent. 316%

Lesson Plan

Text: Financial Algebra
Volume: _Prepare a Budget_ Chapter: __10_____
Unit number _10-1_ Title of unit: Utility Expenses
Developed by: DeAnn Dige deann.dige@kent.k12.wa.us
Date: June 26, 2012

Short Description (Be sure to include where in your unit this lesson takes place):

Utility Expense is the first section of the Prepare a Budget Chapter.

LESSON PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lesson Objectives (Students will be able to:)**
  - Compute the cost of electric, gas, oil, and water for the home.
  - Compute the cost of using specific appliances for specific lengths of time.
  - Compute the time it takes an energy-saving appliance to pay for itself.

- **List of prerequisite skills needed:**
  - Percentage, multiplication, and division skills

- **Vocabulary:**
  - Utility
  - Meter
  - Watt
  - Watt-hour
  - Kilowatt-hour (kWh)
  - Cubic foot
  - Ccf
  - Volume
  - Previous reading
  - Present reading

- **State Standards addressed:** *(You may use your District's Power Standards if applicable, Highlight "Green" Standards)*
  Math:
    - Reason quantitatively and use units to solve problems – Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays
    - Reason quantitatively and use units to solve problems – Define appropriate qualities for the purpose of descriptive modeling

- Interpret the structure of expressions – Interpret parts of expression, such as terms, factors, and coefficients
- Interpret the structure of expression – Interpret complicated expressions by viewing one or more of their parts as a single entity

Reading:

- Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

Writing:

- None relevant

Leadership:

- The student will be involved in activities that require applying theory, problem-solving, and using critical and creative thinking skills while understanding outcomes of related decisions

- **Teacher Preparation:** *(What materials and set-up are required for this lesson?)*
  - Review of chapter material, paper or electronic copies of outline and worksheet
  - Paper or electronic copy of quiz

- **Content Delivery:** *(How will the lesson be delivered? List any grouping and instructional strategies as well.)*
  - PowerPoint on Utility Expenses with Outline for students to take notes and practice problems
  - Chapter Application problems – pg 486-488

- **Instructional Documents** *(Please attach any Worksheet, Quiz, Reading Guide, etc)*
  - Utilities Cost Lab Worksheet

- **Assessment Tool used in this Lesson** *(scoring method, guide, or rubric)*
  - Quiz

- **Reinforcement/Intervention/Extension Activities**
  - http://www.econedlink.org/interactives/index.php?iid=145&type=educator
    - Budget Odyssey – an interactive game

- **Career Applications** *(When will this be used in "real life"?)*
  - When living independently or as part of a family, the financial resources available will be limited, so understanding how money is spent and ways that costs can be reduced are vital in maintaining a budget.
  - Financial planner, business owner/operator, accountant, accounts payable clerk, homeowner, building custodian/maintenance

UTILITY EXPENSES – Concept Quiz

Name _____

Match each of the following terms to the correct definition – write the letter of the term in the answer column

Term	Definition	Answer
a) Ccf	1. Expenses for electricity, natural gas, heating oil, and water that are incurred while living in a home	1.
b) Cubic foot	2. A device that records how much of a particular utility is used	2.
c) Kilowatt-hour (kWh)	3. A unit measure used for electricity	3.
d) Meter	4. A unit for the usage of electricity; for example, a 60-watt light bulb burning for two hours uses 120 watt-hours	4.
e) Present Reading	5. A unit of measure by which electricity is sold; equivalent to 1,000 watt-hours of electrical use	5.
f) Previous Reading	6. A unit of measure by which natural gas and water are sold; it represents the amount of space occupied, not the weight	6.
g) Utility	7. A unit of measure that represents 100 cubic feet	7.
h) Volume	8. The amount of space inside a three-dimensional region, such as a room; volume is measured in cubic units	8.
i) Watt	9. The reading as of the last time the meter was read	9.
j) Watt-hour	10. The current meter reading	10.

11. TRUE or FALSE – Utilities are paid for prior to use.

12. What if the unit of measure for electricity use?

13. Where does electricity come from?

UTILITY EXPENSES – Concept Quiz - Answers

Name _____

Match each of the following terms to the correct definition – write the letter of the term in the answer column

Term	Definition	Answer
a) Ccf	1. Expenses for electricity, natural gas, heating oil, and water that are incurred while living in a home	1. G
b) Cubic foot	2. A device that records how much of a particular utility is used	2. D
c) Kilowatt-hour (kWh)	3. A unit measure used for electricity	3. I
d) Meter	4. A unit for the usage of electricity; for example, a 60-watt light bulb burning for two hours uses 120 watt-hours	4. J
e) Present Reading	5. A unit of measure by which electricity is sold; equivalent to 1,000 watt-hours of electrical use	5. C
f) Previous Reading	6. A unit of measure by which natural gas and water are sold; it represents the amount of space occupied, not the weight	6. B
g) Utility	7. A unit of measure that represents 100 cubic feet	7. A
h) Volume	8. The amount of space inside a three-dimensional region, such as a room; volume is measured in cubic units	8. H
i) Watt	9. The reading as of the last time the meter was read	9. F
j) Watt-hour	10. The current meter reading	10. E

11. TRUE or FALSE – Utilities are paid for prior to use.

12. What if the unit of measure for electricity use? Watt

13. Where does electricity come from? Answers may vary – possibilities include: wind, water, nuclear power, etc

Utility Expenses Outline

Name _____

Key Terms

1. Utility –
2. Meter –
3. Watt –
4. Watt-hour –
5. Kilowatt-hour (kWh) –
6. Cubic foot –
7. Ccf –
8. Volume –
9. Previous reading -
10. Present reading –

Example 1:

Check Your Understanding: Ron used x ccf of water during the summer month. Express the number of cubic feet of water he used algebraically. (pg 483)

Example 2:

Check Your Understanding: What is the ccf reading indicated by the dials? (pg 483)

Example 3:

Check Your Understanding: An appliance uses ***w*** watts. If you run it for ***m*** minutes, and the cost per kilowatt-hour is ***c***, express the cost of running the appliance for ***m*** minutes algebraically.

Example 4:

Check Your Understanding: Two years ago, the Halloran family used ***y*** dollars of electricity. Last year, they used balanced billing. During last year, they used ***x*** dollars of electricity, and their balanced billing payments were not enough to pay for their electric usage. They had to pay the difference at the end of the year. Express algebraically the amount they owed the utility company.

Example 5:

Check Your Understanding: An old dishwasher costs ***r*** dollars to run for a year. It is replaced by a new energy-efficient dishwasher that costs ***c*** dollars a year, but saves ***p*** percent per year in energy usage. Express algebraically the number of years it will take for the dishwasher to pay for itself.

Web Resources
Chapter 10, Section 1

http://www.practicalmoneyskills.ca/foreducators/lessonplans/plans/activities/loansExpenses/s_lesson04_livingown_100709.pdf

- Includes 26 pages of lesson plans, worksheets, and answer key related to expenses of living independently; including fixed vs variable expenses and rental/lease agreements

http://www.practicalmoneyskills.ca/foreducators/lessonplans/plans/activities/loansExpenses/s_lesson04_livingown_100709.pdf

- Lesson plan for paying utility expenses at a lower level for differentiation with IEP or ELL students

http://pages.minot.k12.nd.us/votech/File/mylife/lesson3.htm

- Useful for the entire chapter. Has fill-in-the blank activities to track expenses in different areas

http://www.toptenusa.org/Energy-Saving-Tips-News/How-to-Read-Your-Utility-Bill

- Gives an overview of how to read your electric bill then provides a typical breakdown of how much energy is used in the home for heating/cooling, and a variety of appliances

http://www.youtube.com/watch?v=zJn8ZFN1jzM

- You Tube clip on how to read you electric bill

http://www.econedlink.org/interactives/index.php?iid=145&type=educator

- Budget Odyssey – an interactive game

http://www.consumerspower.org/home_energy/billestimator.php

- Estimating Electric Bill calculator

http://www.financialeducatorscouncil.org/

- The Financial Literacy Project – free resource of curriculum after signing up