Title: Choosing the Correct Heating System

Objectives

Students will be able to solve multi-step problems in order to calculate BTU and determine the best heating system for various spaces.

Time frame to Complete

45 minutes

NRS EFL

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Stackable Cert. Documentation	Technology	Study / Life skills	EL-Civics	Career Pathways	Police	Paramedic	Fire Rescue	Medical Asst.	EKG / Cardio	Phlebotomy	Practical Nursing	Healthcare Admin	Pharmacy Tech	IMT	AMT	HVAC	Welding	Other:					
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Standard(s) Addressed in Lesson

Benchmark(s) Addressed in Lesson

- M.4.5 Estimate (when appropriate) and compute solutions to problems involving fractions, decimals, ratios, proportions and percents.
- M.4.25 Solve multi-step problems.

Materials

- *Heating System Requirements* worksheet
- Pencil
- Calculator (optional)

Learner Prior Knowledge

Multiplication, decimals, average, rounding

Activities

Step 1 Distribute the *Heating System Requirements* worksheet. Explain to students that heating systems are sized depending upon the number of BTUs (British Thermal Units) needed to heat the space. This lesson will teach them the process of calculating BTU's in order to determine the best sized heating system for a space.

Step 2 Review the formulas for calculating volume (cubic feet of space per room), averages, and BTUs (as indicated on the worksheet).

Step 3 Students complete the problems. (They may check their work with a calculator, if desired.)

Step 4 Check and re-teach as necessary.

Assessment/Evidence

Completed *Heating System Requirements* worksheet.

Adaptations for Beginning Students

Students may use a calculator and/or work with a partner to solve the problems.

Adaptations for Advanced Students

Advanced students should have 100% accuracy and should be able to solve the problems without using a calculator.

Teacher Reflection/Lesson Evaluation

This lesson was created by Middletown ABLE.

Choosing the best heating system

Determining the size of the best heating system for a building requires several basic mathematical calculations.

Step One: The first calculation is the volume (cubic feet) of the space to be heated. To find the volume of the space, measure the length, width, and height of the each room to be heated. Multiply those measurements together.

Room 1: length	16 feet width	X	10 feet height	X	8 feet	=	**1280**	cubic feet

Complete this step for each room to be heated by the system and determine the total volume. For example, if a house had five rooms with the same measurements as above, the total space to be heated would be 5 x 1280, or 6400 cubic feet.

Step Two: The next required measurement is the number of degrees the temperature will need to be raised. If the low temperature of the area averages 36 degrees in the winter, and the desired indoor temperature in the space is 70 degrees, the heating system will need to raise the temperature 34 degrees. This was calculated by subtracting the average low temperature from the desired temperature.

70 - 36 = **34** degrees

Step Three: Calculate the BTU (British Thermal Units) for the heating system by multiplying the total cubic feet of the space by 0.133. Multiply the result by the number of degrees the temperature will need to be raised.

6400 total cubic feet	x	0.133	=	851.2		
851.2	x	34 degrees	=	28940.8	BTU	

Heating systems typically come in sizes 40,000 BTU, 60,000 BTU, 80,000 BTU, 100,000 BTU, and 120,000 BTU. Choose the size nearest (and greater than) the needs determined in Step Three. In this example 28,941 is closest to 40,000 BTU, so a **40,000 BTU system** is the best choice for the space.

1. Find the average low temperature from this group of weekly lows:
33, 32, 28, 30, 31, 32, 32, 34, 33

2. The average winter low temperatures for Hamilton, Ohio are:
   - December 32
   - January 31
   - February 34

If the desired temperature of an office building is 68 degrees, how many degrees will the heating system need to raise the temperature of the space?

3. Calculate the BTU for a space measuring 10,750 cubic feet with a heating requirement of 30 degrees.

4. Calculate the BTU for a space measuring 8,312 cubic feet with a heating requirement of 35 degrees.

5. Determine the best heating system for the following homes.

House 1 room measurements:
10x10x8
10x15x8
10x18x8
18x15x8
15x15x8
6x8x8

Desired temperature increase = 30 degrees

What size heating system is required? _____

House 2 room measurements:
12x18x8
15x12x8
20x18x8
16x15x12
10x10x8
8x6x8

Desired temperature increase = 35 degrees

What size heating system is required? _____

Choosing the best heating system KEY

1. Find the average low temperature from this group of weekly lows:

33, 32, 28, 30, 31, 32, 32, 34, 33

33+32+28+30+31+32+34+33 = 253

253/9 = 28.11

28 degrees

2. The average winter low temperatures for Hamilton, Ohio are:
   - December 32
   - January 31
   - February 34

If the desired temperature of an office building is 68 degrees, how many degrees will the heating system need to raise the temperature of the space?

97/3 = 32.3

32 degrees

68-32 = 36 degrees

3. Calculate the BTU for a space measuring 10,750 cubic feet with a heating requirement of 30 degrees.

10,750 x 0.133 = 1429.75

1429.75 x 30 = 42892.5 BTU

4. Calculate the BTU for a space measuring 8,312 cubic feet with a heating requirement of 35 degrees.

8312 x 0.133 = 1105.496

1105.496 x 35 = 38692.32 BTU

5. Determine the best heating system for the following homes.

House 1 room measurements:

10x10x8 = 800

10x15x8 = 1200

10x18x8 = 1440 7784 cubic feet

18x15x8 = 2160

15x15x8 = 1800

6x8x8 = 384

Desired temperature increase = 30 degrees

7784 x 0.133 = 1035.272

1035.272 x 30 degrees = 31,058.16 BTU

What size heating system is required? _____40,000 BTU_____

House 2 room measurements:

12x18x8 = 1728

15x12x8 = 1440

20x18x8 = 2880 10112 cubic feet

16x15x12 = 2880

10x10x8 = 800

8x6x8 = 384

Desired temperature increase = 35 degrees

10112 x 0.133 = 1344.896

1344.896 x 35 degrees = 47071.36 BTU

What size heating system is required? ____60,000 BTU_____