

The Candle Lab

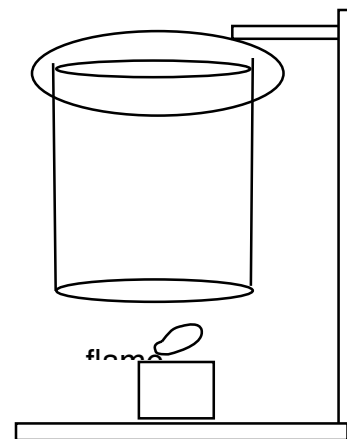
In this activity you will determine the energy content of various combustable substances in calories per gram.

Materials (per group)

balance	empty aluminum soft-drink can with cross-wire supports	
combustable substances	thermometer/Lab Quest	
ring stand	tap water	ring

Procedure

1. **Mass the candle**
2. **Mass the can.**
3. Put 100 ml of water into the can.
4. **Mass the can and the water.**
5. Hang the can on the ring stand.
6. Place a thermometer in the can.
7. **Record the temperature of the cold water.**
8. Place the item under the center of the can as shown in the diagram on this page. Adjust the height of the ring so that the bottom of the can is about two centimeters above where the flame will be.
9. Light the flame
10. **After the temperature has raised about 10 - 15 degrees, extinguish the flame and record the temperature.**
11. **Record the mass of the item again.**
10. Complete the data table below
11. Repeat for the other two items.



GRAPH EACH TRIAL on the SAME graph. Hit RECORD before lighting the flame.

Raw Data

	Candle	Butane	Ethanol
Mass of material before burning	<u>42.80 g</u>	<u>16.69 g</u>	<u>145.60 g</u>
Mass of material after burning	<u>42.67 g</u>	<u>16.44 g</u>	<u>144.50 g</u>
Mass of can	<u>14.21 g</u>	<u>14.21 g</u>	<u>14.21 g</u>
Mass of can and water	<u>121.63 g</u>	<u>188.79 g</u>	<u>256.74 g</u>
Initial temperature of water	<u>33.8 C</u>	<u>21.97 C</u>	<u>22.9 C</u>
Final temperature of water	<u>40.47 C</u>	<u>31.1 C</u>	<u>32.2 C</u>

Derived Data — — SHOW WORK

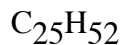
Change in mass of substance burned	_____	_____	_____
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Mass of Water	_____	_____	_____
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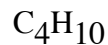
Δ Temperature of water	_____	_____	_____
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Chemical Heat Lab Conclusion Questions

Parafin



Butane



Ethanol C_2H_5OH

3. Record the class average calories/gram for each substance.

candle _____

butane _____

ethanol _____

4. Which substance released the most calories per gram?

Do questions 5 - 7 for each substance. Use the class averages.

5. Calculate the heat released in calories/mole. 3 calculations.....

6. Calculate the heat released in joules per mole. (1 calorie = 4.18 Joules) 3 calculations.....

7. Calculate the heat released in KJ per mole. 3 calculations.....
8. Write chemical equations for all THREE reactions. The products are carbon dioxide and water. 3 equations.
9. Does the number of calories absorbed by the water represent all of the heat released by the candle? Explain your answer.
10. What is the definition of Heat of Combustion?