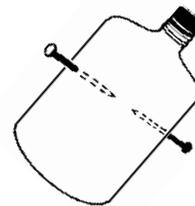
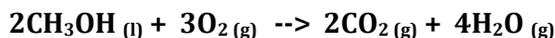


# The Methanol Cannon



## **Background:**

A small amount (less than 1 mL) of colorless methanol,  $\text{CH}_3\text{OH}(\text{aq})$ , is added to a 1-L plastic bottle which has two nails protruding from the sides. The bottle is capped firmly with a rubber stopper and swirled to vaporize and distribute the methanol gas. The neck of the bottle is clamped tightly and attached to a ring stand. A spark is applied to the head of one of the nails protruding from the side of the bottle. The result is a loud explosion and the rubber stopper is propelled across the room. The methanol is reacted with oxygen in the air and the reaction is shown below.



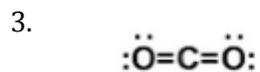
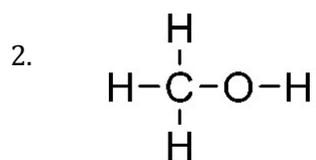
## **Applications:**

1. Classify the type of reaction that took place above.
2. Draw the structural formula for  $\text{CH}_3\text{OH}$ .
3. Draw the Lewis structure for  $\text{CO}_2$ .
4. State one physical property of methanol.
5. The flash point is the temperature at which a particular organic compound gives off sufficient vapor to ignite in air. The flash point of methanol is  $12^\circ\text{C}$ . What is the flash point temperature in Kelvin?
6. Based on your observations of this demonstration performed in class, state evidence that a chemical change took place.

7. Identify the type of chemical between the C-H atoms in methanol.
8. State, in terms of charge distribution, why methanol is considered a polar molecule.
9. Determine the molar mass of methanol.
10. Calculate the percent composition of hydrogen in methanol. Your answer must include a correct numerical set-up and your answer.
11. Inside the plastic bottle, liquid methanol evaporates very rapidly. Explain, in terms of intermolecular forces, why the methanol evaporates so rapidly.
12. Methanol ( $\text{CH}_3\text{OH}$ ) can be burned as an alternative to fossil fuels. For the balanced reaction performed in this demonstration, determine the amount of water that is formed when 4.00 moles of  $\text{CH}_3\text{OH}$  reacts with excess  $\text{O}_2$ .

## Answer Key

1. Combustion



4. colorless, liquid, evaporates...

5. 285K

6. new products were formed, gases formed

7. covalent, polar covalent

8. polar

9. 32.0g/mol

10.  $4/32 \times 100 = 12.5\%$

11. weak IMF

12. 8.00 moles