



## THE SMOKING FLASK (AKA 'STAGE SMOKE')

### EFFECT:

A flask of solution changes colour while producing copious quantities of fog.

### DESCRIPTION:

A large conical flask contains a light-green liquid. When some pellets are dropped in, the solution changes to a yellow, or eventually red, colour while producing huge amounts of mysterious white fog, like something from an episode of Doctor Who. This fog will pour out of the flask and drift spookily across tables and the floor.

### HOW IT WORKS:

The flask contains some universal indicator and tap water (which is pretty much neutral). The pellets are dry ice which is carbon dioxide in its solid state. Carbon dioxide will freeze into a solid at temperatures below  $-78.5\text{ }^{\circ}\text{C}$  and go straight back into a gaseous state – known as sublimation – when it heats back up. The water warms the carbon

dioxide up and it is gaseous carbon dioxide that fumes out of the beaker looking like fog because of the water vapour in the air that condenses onto the cold carbon dioxide fumes. Because carbon dioxide is heavier than air and is still colder than the air in the room, the fog i.e. condensed water vapour will follow the trail of carbon dioxide fumes and sink down and flow across the floor.

As the gaseous carbon dioxide bubbles up through the water, some of it dissolves into solution. This causes a reaction producing carbonic acid, turning the indication yellow and eventually red. This is the same acid that is produced in carbonated "fizzy" drinks which uses dissolved carbon dioxide to produce the bubbles. This is why sparkling mineral water has a sharp, acidic taste.

### CHEMICAL INFO:

$\text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) = \text{CO}_2(\text{aq})$  (most  $\text{CO}_2$  forms a 'hydrate' i.e.  $\text{CO}_2(\text{H}_2\text{O})_6$ )

only a small proportion actually reacts to form carbonic acid ( $\text{H}_2\text{CO}_3$  a weak acid)

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### HINTS AND TIPS:

Dry ice is extremely cold and should be handled with great caution. If it contacts skin for too long it can cause severe freeze-burns. Always use insulating gloves when handling dry ice.

The gaseous carbon dioxide that is produced is heavier than air and will sink to the ground. This is not a problem if you are in a big room, but in a small enclosed space it could push all of the air out and you will suffocate. Always ensure ventilation windows and doors are open (if possible) have someone else around if you are producing a gas that displaces air.

