



21 Carbon monoxide and carbon

Carbon monoxide		CO
Extremely flammable		<p>R12: Extremely flammable. R61: May cause harm to the unborn child. Category 1 teratogen. R23: Toxic by inhalation. R48/23: Toxic: danger of serious damage to health by prolonged exposure through inhalation.</p> <p>This gas has no taste or smell. 0.01% in air can cause headaches. It is the product of incomplete combustion of fuels in industrial heating boilers. Forms explosive mixtures with air above a 12% concentration.</p> <p>The gas is <i>not</i> absorbed by filters in recirculatory fume cupboards.</p> <p>Flash point: -191 °C.</p> <p>WEL (mg m⁻³): 35 (LTEL), 232 (STEL).</p>
Toxic		
<p>Store: Situ Cylinders should not be used. Small volumes can be made in situ.</p>		<p>Disposal: W6</p>

Carbon		C
	Activated carbon; charcoal: graphite; lamp black	
Low hazard	-	<p>Sometimes supplied as a very fine powder.</p> <p>Dangerous with: OXYGEN: Finely-divided carbon is a fire hazard. Used, hot carbon blocks can cause fires when stacked.</p> <p>WEL (mg m⁻³): 3.5 (LTEL), 7 (STEL).</p> <p>If dust is spilt in laboratories: Wear a dust mask (FFP1 grade) for a large spill. Sweep up slowly as much as possible, so as not raise airborne particles. Finally wash the area.</p>
Store: Gln	Disposal: W8	

Activity	User	Control measures	Experimental points
Reduction of metal oxides with carbon powder or blocks	Y7	Wear eye protection. Tie long hair back. The room should be well ventilated. After use, cool carbon blocks in air. Store in an air-tight metal container eg, a biscuit tin. Do not cool carbon blocks in cold water.	Metal oxides can be heated with powdered carbon in a crucible or bottle top. To stop re-oxidation, another bottle top can be placed on top and 'tied' together with nichrome wire. Blowpipe method: To reduce the amount blown into the air, mix the oxide with a little water to dampen it before placing the paste on the carbon block. Rubber tubing can be connected to the blowpipe. Alternatively, make a depression in a piece of soft wood with an old screwdriver and, using the blowpipe, char it before adding damp metal oxide. Wood blocks can be doused in water.
Decolourising charcoal	Y7	Wear eye protection.	Emphasise that only very small amounts are required to absorb dyes or indicators. It may need to be distributed by the supervisor.
Carbon monoxide test	Y9	Wear eye protection.	Ignite carbon monoxide with a lighted splint. It burns with a blue flame.
Distillation of coal	Y9	Wear eye protection. Wear disposable nitrile gloves. The room should be well ventilated.	Watch carefully those children with known breathing difficulties. Burn off the gases from this reaction. Be aware of suck back from the side-arm test tube once the heating stops. See <i>Handbook</i> 13.2 for more details and a diagram of the apparatus.
Preparation of carbon monoxide	Y12	Wear eye protection. Wear disposable nitrile gloves.	Drip 2 cm ³ of concentrated sulfuric(VI) acid onto 0.5 g sodium methanoate. Warm very gently. Larger volumes should be prepared by the teacher/technician using a ducted fume cupboard.
Reaction of carbon monoxide with blood	Y12	Wear eye protection. Wear disposable nitrile gloves. Use a ducted fume cupboard.	Prepare gas as above but adapt the method so that it may be passed through animal blood. Alternatively, adapt the procedure by using a syringe as in <i>School Science Review</i> , 54, 1972 p303. For hygiene and blood spills, consult <i>Handbook</i> 14.13.
Reduction using carbon monoxide	TT	Wear eye protection. Use safety screens. Use a ducted fume cupboard.	This involves a larger-scale preparation of the gas. Methanoic acid is dripped onto concentrated sulfuric(VI) acid. The heat evolved is enough to initiate the reaction. The gas is passed over heated lead(II) oxide and through limewater. Unreacted carbon monoxide can be passed to a working, ducted fume cupboard or through an open window. See <i>Handbook</i> 13.