Case Studies on Laboratory Accident – your comments and suggestions

Case #1 : Gas tap without burner

Two-way gas taps are commonly installed in school science laboratories. For one reason or another, not all gas taps are connected to Bunsen burners. In an attempt to light a Bunsen burner, a student mistakenly turned on the adjacent gas tap not connected to the burner. Gas emitted from the gas tap burst into flames. Fortunately, the student was able to turn off the tap immediately but still she sustained a minor heat burn in her hand and hair charred.

Case #2 : An accident caused by improper heating

A student was heating a test tube containing a mixture of chemical liquids. Instead of heating the mixture gently, he heated it strongly without shaking. After heating, he immediately put the test tube under the nose of a girl student standing next to him for her to smell the gas evolved. Both students were not wearing safety spectacles. The hot mixture of chemical liquids suddenly squirted out of the test tube onto the left eye and face of the girl student, who screamed consequently for help. The laboratory technician immediately took the injured student to the preparation room and washed her left eye and face with distilled water continuously until the ambulance personnel summoned by the school arrived. The injured student was taken to the hospital and given medical treatment. Fortunately, the student's injuries were not permanent, but she had suffered a great deal of pain and had to take sick leave for a week.

Case #3 : An accident involving phenol

A student tested the solubility of phenol in water by heating a phenol-water mixture in a stoppered test-tube over a boiling water bath. The stopper of the test-tube suddenly popped out and the contents spurted onto the face of the student. The affected area was burnt.

Case #4 : An eyes accident

Some students were performing an experiment on oxidation of cyclohexanol to cyclohexanone using Quickfit apparatus. The accident happened when a group of students were assembling Quickfit apparatus to a retort stand using boss and clamps. Due to incorrect use of the boss head, a clamp loosened and a flask containing the reaction mixture dropped onto the bench. Some of the mixture, which contained cyclohexanol, sodium dichromate and sulphuric acid, splashed onto the eyes of a girl student. The student was wearing contact lenses but not any other spectacles, though the class had been instructed to wear safety spectacles in the lesson. The teacher and laboratory technician immediately washed the student's eyes with water. The contact lenses were removed. As the student did not reported discomfort in her eyes, the school had not sent the girl to hospital for treatment but had advised her to seek medical consultation should there be any discomfort in her eyes. The student went to a private clinic afterwards and found that her eyes suffered no injury.

Case #5 : Phosphorus burns

A teacher cut up a stick of yellow phosphorus into small pieces for group experiment. He turned to write on the blackboard, while a student mischievously stole a piece of phosphorus and hid it in the pocket of his trousers. After a while, his trousers caught fire. The upper thigh of the student was seriously burnt. His hand was burnt too when he tried to remove the piece of burning phosphorus from his pocket.

Case #6 : An accident involving sulphur dioxide

A class of students was performing an experiment on investigation of elements and compounds in groups of 4 students. Small amount of sulphur/iron mixture was heated strongly in the experiment and a certain amount of sulphur dioxide was produced. The teacher had instructed the class to use minimum amount of chemicals and to heat the mixture for about five minutes only. He had turned on the ceiling fans and the windows of the laboratory. However, he had forgotten to turn on the exhaust fans. Apparently, some students used more than enough sulphur and heated the mixture for too long. A student felt discomfort on his respiratory tract and reported to the teacher. The student was quite sensitive to effects of sulphur dioxide and his thyroid gland swelled to an extent that it made him difficult to breathe. The student received tonsillectomy few days after the accident. It was only informed after the accident that the student had been suffering from infectious problems in his thyroid glands.

Case #7 : A fire caused by calcium carbide

A laboratory attendant working in the Chemistry laboratory noticed that white fumes and flame emerged from a locked wooden cupboard containing hazardous chemicals. He instinctively tried to put out the fire by using a bucket of water. After he had poured the water onto the cupboard, more white fumes and flame came out from the cupboard. He then informed the principal and subsequently the fire brigade was summoned for help. The firemen quickly put out the fire on arrival. The laboratory attendant felt ill after inhaling the fumes and was sent to the hospital. It was later found that the chemical causing the accident was calcium carbide.

Case #8 : Ethanol on fire

A group of students tried to test the flammability of ethanol by burning it in a watch glass. When the ethanol was about to burn off, one of the students attempted to add more ethanol from a test-tube. In doing so, the ethanol in the test-tube got ignited and the burning ethanol spurted out. The student on the opposite side of the bench had his face and upper arm burned and his hair charred.

Laboratory Accident Case Studies - some recommendations

Case #1 : Gas tap without burner

1. Teachers should ask students to tie up their long hair.
2. Teachers should prompt students about the potential danger in the careless handling of Bunsen burners and gas taps.
3. Schools should also secure all unused gas taps in order to prevent them from being mistakenly turned on by students. For pressdown type gas tap, the unused gas tap can be secured by fixing a hose clip under the gas tap knob to prevent it from being turned on mistakenly (see Fig. 1). For gas tap with automatic shut-off facility and a safety valve, the unused gas tap can be tied up, such as by using a nylon cable tie, to prevent it from being turned on mistakenly (see Fig 2). Appropriate labels may also help students to identify the correct gas taps.

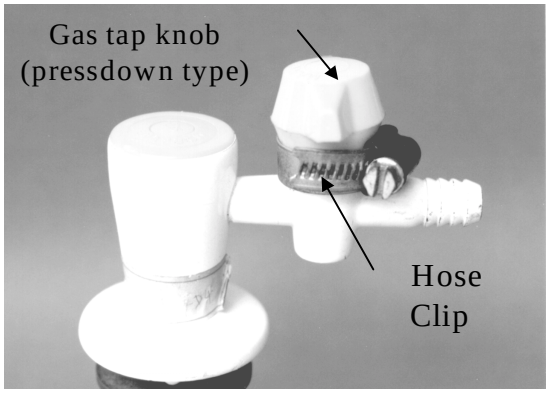

Figure 1

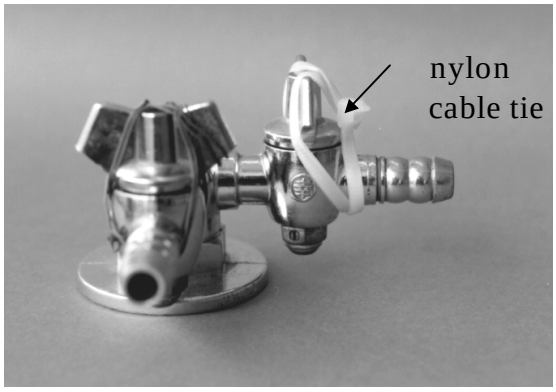

Figure 2

Case #2 : An accident caused by improper heating

1. Students should wear safety spectacles when doing experiments.
2. Students should follow relevant experimental procedures closely when doing experiments (e.g. when only gentle heating is required do not apply strong heating).
3. Teachers should ensure that students are aware of the relevant experimental techniques before doing experiments. During experiments, students should execute these techniques properly (e.g. shaking a test tube of chemical liquids properly on heating; smelling gases evolved from a test tube by means of waving the gases towards the nose, but not directly above the test tube).

Case #3 : An accident involving phenol

1. Heating should never be applied to closed system such as a stoppered test-tube.
2. Appropriate protective equipment such as safety spectacles should be worn when handling corrosive chemicals.
3. Students should be warned beforehand of the possible hazards when handling hazardous chemicals.

Case #4 : An eyes accident

1. All accidents involving the eyes should be regarded as serious and medical advice should be sought immediately.
2. While working in science laboratories safety spectacles should be worn whenever there is any potential risk of eye injury. Safety spectacles should always be put on when heating chemicals, handling acids, alkalis and other corrosive chemicals, working with glass apparatus under pressure, or carrying out potentially violent or exothermic reactions.
3. Students should be taught the correct way of using retort boss and clamps.
4. Students should be advised not to wear contact lenses during practical lessons because some chemicals are preferentially absorbed by plastic lenses. Besides the gap between the lenses and the cornea of eyes tends to retain any chemical liquids splashed accidentally onto the eyes and may lead to more serious damages.

Case #5 : Phosphorus burns

1. Students should be warned beforehand of the possible hazards when handling hazardous chemicals.
2. Hazardous chemicals should not be left unattended.
3. Experiments involving the use of phosphorus (yellow or red) should only be done as demonstration.

Case #6 : An accident involving sulphur dioxide

1. When performing experiments involving harmful gases / vapour, good ventilation should always be maintained by opening the windows, switching on the ceiling fans and exhaust fans as appropriate.
2. Perform the experiments on a small scale (e.g. use a small amount of sulphur) and preferably inside a fume cupboard.
3. When heating mixture of iron and sulphur, the mixture should be removed from heat when it starts to glow. Heat the mixture again until the glow just goes out. This could minimise the evaporation of sulphur directly to give sulphur vapour or formation of sulphur dioxide. Do not get too close to the fumes.

Case #7 : A fire caused by calcium carbide

1. Regular checks should be carried out to ensure that the hazardous chemicals were properly stored under appropriate conditions. Guidelines on the storage of hazardous chemicals were provided in the handbook *"Safety in Science Laboratories"* published by the Education Department.
2. Laboratory users should be warned that water should not be used for the purpose of putting out fires caused by chemicals. They should be taught how to use the carbon dioxide type and the powder type fire extinguishers.
3. Excessive chemicals, especially excessive hazardous chemicals, should not be acquired.

Case #8 : Ethanol on fire

1. Flammable liquids should never be added to a container with burning fuel.
2. Students should be warned beforehand of the possible hazards when handling flammable chemicals.