Indoor Air Quality

Science

Secondary School S.1-S.3

Teacher's Edition

Secondary 1-3

✧ **Why is indoor air quality important?**

1. Look at the pictures below and discuss with your group members:

   How would you feel if you were in the conditions below? Why?

Bedroom with windows closed

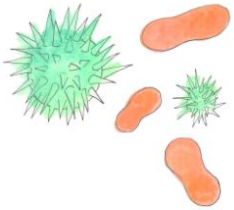
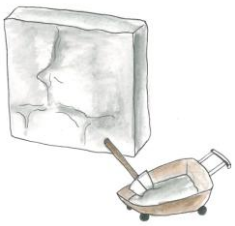
Crowded hall

Working place with an air conditioning system, working copier and smoke

2. Find out the places in which you and your family members always stay and evaluate the indoor air quality of these places.

✧ **Common pollutants of indoor air quality, their sources and solution to problem:**

Watch the video, match pollutants to their sources and solutions to the problems.

IAQ pollutants	Sources	Solution
Carbon dioxide	 Household or consumer products such as insecticides	Use aerosol products with caution
Biological contaminants	 From Living things	Maintain good ventilation
Volatile organic compounds	 From people, pets and plants, including bacteria, fungi	Clean the carpet and bedding regularly
Formaldehyde	 Building materials	Select lower formaldehyde products
Radon	 New furniture	

Conclusion: It is important to maintain good ventilation for good indoor air quality.

✧ **Convert PPMV to %:**

Unit of CO_2 (PPMV): means "parts per million by volume", 10^{-6}.

In the atmosphere, normally $CO_2 \approx 390$ PPMV.
Then calculate % of CO_2 in the air.
(***Answer: $CO_2 \approx 390$ PPMV≈ 0.039 % in the air***)

✧ Summary

1. Indoor air quality and its importance:

We spend more than 70% of our time at home, and in offices and other indoor environments. Poor indoor air quality can lead to discomfort, illnesses (e.g. headaches, itchy eyes, respiratory difficulties, skin irritation, nausea and fatigue), as well as absenteeism and lower productivity in the workplace. Children, the elderly and those with existing respiratory or heart disease are more susceptible to the effects of poor indoor air quality. Good indoor air quality safeguards the health of buildings' occupants.

2．Common pollutants causing poor indoor air quality and their sources:

- **Carbon dioxide:** from the breathing of living things. High levels of CO_2 are caused by overcrowding and infrequent window opening. It will make you feel sleepy and provide a warning of the possible build-up of other indoor air pollutants.
- **Biological contaminants:** from people, pets and plants, including bacteria, fungi and microscopic allergens. The growth of biological contaminants may be accelerated by inadequate ventilation and high humidity. They may cause sneezing, watery eyes, coughing, shortness of breath, dizziness, lethargy, allergy and asthma.
- **Volatile Organic Compounds (VOCs):** from household or consumer products, dry cleaning and products for wall painting or paint stripping. This will irritate your eyes, nose and throat, and even worse, may cause cancer.
- **Formaldehyde:** from pressed wood products made with urea-formaldehyde resins. A high level of formaldehyde will irritate your eyes, nose and throat.
- **Radon:** from building materials and it can accumulate to a high concentration if the premises are poorly ventilated. Exposure to elevated radon and its decay products may increase the

incidence of lung cancer.

- **Environmental tobacco smoke from smoking (second-hand smoke):** this is a mixture of the smoke given off by the burning end of a cigarette, pipe or cigar, and the smoke exhaled by the smoker. It causes eye, nose and throat irritation, and may significantly increase the risk of lung cancer and other respiratory illnesses.
- **Ozone:** can be produced by equipment that utilizes ultra-violet light or causes ionization of the air including photocopiers, laser printers and fax machines. Ozone is highly reactive and can cause serious damage to the lungs if inhaled in high concentrations. It also irritates the eyes and respiratory tract.

3. How to improve indoor air quality:

- Sufficient ventilation should be maintained, windows should be opened often to increase ventilation;
- If air-conditioners are used, good ventilation with sufficient fresh air supply should be maintained;
- Clean regularly the ventilation system including air filter and ducting. Maintain the system in good working condition at all times;
- Kitchens and bathrooms should be equipped with exhaust fans;
- Keep the house clean; clean the carpet and bedding regularly;
- Avoid unnecessary partitioning of houses;
- Avoid using consumer products with volatile organic compounds;
- Move into a new building only when it has been "aired" adequately;
- Do not smoke;
- Provide local exhaust for polluting activities, such as heating, cooking, redecoration, photocopying and smoking;
- Use aerosol products such as pesticide with caution.

✧ More information can be found at the following websites:

- Environmental Protection Department —Hong Kong ; http://www.iaq.gov.hk/
- World Health Organization; http://www.who.int/indoorair/en/
- US Environmental Protection Agency—United States; http://www.epa.gov/iaq/
- The Canadian Centre for Occupational Health and Safety —Canada; http://www.ccohs.ca/oshanswers/chemicals/iaq_intro.html/
- Department of Sustainability, Environment, Water, Population and Communities — Australia; http://www.environment.gov.au/atmosphere/airquality/publications/sok/index.html/
- Occupational Safety & Health Administration—United States; http://www.osha.gov/SLTC/indoorairquality/
- Publications and Resources The Inside Story: A Guide to Indoor Air Quality—United States; http://www.epa.gov/iaq/pubs/index.html#insidestory/