

Indoor Air Quality

Liberal Studies
Secondary School S.4 - S.6
Teacher's Edition



Secondary 4-6

✧ **What is indoor air quality?**

Activity One:

Choose the number(s) of situation (problems) that frequently encounter in your daily life (normally these situations would affect indoor air quality):

- (1) Stay in a crowded room with poor ventilation;
- (2) Somebody smokes around you or in your presence;
- (3) You prefer to use the air-conditioner rather than open windows;
- (4) You have recently bought a new set of pressed-wood furniture;
- (5) The house is full of cooking fume when cooking.

Activity Two:

Match the above (1) to (5) problems and their reasons (A) to (E).

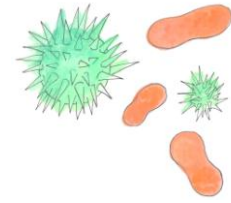
Situation	Reasons of problems	Solutions
(1) Stay in a crowded room with poor ventilation	(A) Less fresh air enters the room, stuff air is difficult to release outside, less ventilation	Keep good ventilation with sufficient fresh air, open windows
(2) Somebody smokes around you or in your presence	(B) Accumulate too much CO ₂ , and other indoor air pollutants	Keep good ventilation with sufficient fresh air, open windows
(3) You prefer to use the air-conditioner rather than open windows	(C) Emit lots of pollutants generated from smoking	No smoking
(4) You have recently bought a new set of pressed-wood furniture	(D) Poor kitchen ventilation	Turn on kitchen ventilators, avoid open kitchen
(5) The house is full of cooking fume when cooking	(E) Indoor emission of formaldehyde from pressed wood furniture	Buy low formaldehyde furniture

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

Activity Three: Pick up one scene from (1) to (5), and discuss the solutions.

【Mini Encyclopedia】 Common pollutants of poor indoor air quality and their sources:

- **Carbon dioxide:** always from living things (peoples, pets and plants), and high levels of CO₂ 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 which may be accelerated by inadequate ventilation and high humidity. They may cause sneezing, watery eyes, coughing, shortness of breath, dizziness and lethargy.
- **Volatile Organic Compounds (VOCs):** from household or consumer products, dry cleaning and products for wall painting. This may cause discomfort, and even worse, 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):** it 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 like photocopiers, laser printers, fax machine, etc. that utilizes ultra-violet light or causes ionization of the air. 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.



✧ **How to improve indoor air quality:**

Think and discuss:

Activity Four: If you are an architect, you are going to do an interior design a room of a hotel.

Whether you would choose the following design and why?

1. Install air conditioning systems;
2. Use carpets;
3. Use wooden furniture.
4. Put potted plants *.

	Pros	Cons
1. Adopt air conditioning systems	Comfortable as suitable temperature and humidity, especially in cold winter and hot summer times.	Waste energy, not enough fresh air circulation
2. Use carpets	Sound proof, grand feel, comfortable	In some humid time, some biological pollutants grow on them, accumulation of dust
3. Use wooden furniture	Easy to get	May emit formaldehyde
4. Put potted plants *	Green look	Might cause asthma or any other respiratory illness by pollen

Activity Five: Please refer to the supplementary information about Radon, discuss and suggest how to tackle the indoor Radon problem. (Key answer: Keep good ventilation with sufficient fresh air and open windows, adopt granite as construction and renovation material moderately.)

【Worldwide Views】

Search the following links and learn more about the indoor air quality standard and systems of other countries.

- 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/>

- * Information on potted plants and IAQ, —United States;

<http://www.epa.gov/iaq/pubs/hpguide.html#faq7>

Supplementary Information

【Introduction to IAQ】 : 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, ill health (e.g. headaches, itchy eyes, respiratory difficulties, skin irritation, nausea and fatigue), as well as absenteeism and lower productivity in workplace. Children, the elderly and those with existing respiratory or heart disease are more susceptible to the impacts of poor indoor air quality. Good indoor air quality safeguards the health of buildings' occupants.

(1) Radon and its Decay Products

Radon is a radioactive gas that has no taste, smell or colour. It is formed when radium found in soils and rocks, particularly granite, disintegrates radioactively. As radon further decays, a series of tiny radioactive particles are formed. When either the gas or these particles are inhaled, some will be deposited in the lungs and continue to emit radiation.

Granite is very widely used in concrete for building construction in Hong Kong and hence may have the potential for radon emission. If a building is not well ventilated, the emitted radon will become trapped and accumulated. In addition, radon can diffuse into the indoor air from building materials or from soil gas seeping up through cracks or openings in the ground.

(2) Biological contaminants in Hong Kong

In Hong Kong, biological contaminants are another main pollutant of indoor air quality. Biological contaminants include bacteria, fungi, viruses and dust mites. There are many kinds and sources of these contaminants. Bacteria are carried by people, animals, and soil and plant debris. Dust mites flourish in damp and warm environments such as mattresses, bedclothes and heavily used upholstered furniture. Poorly maintained ventilation systems can be the breeding grounds for fungi and other biological contaminants. Symptoms of health problems caused by biological contaminants include sneezing, watery eyes, coughing, shortness of breath, dizziness, lethargy, fever and digestive problems.

The weather and environment of Hong Kong are always wet. Bacteria may breed if bedclothes and carpets do not undergo periodic cleaning and it may lead to poor indoor air quality and harm to human health.