
NATIONAL EXAMS MAY 2013

07-Bld-B7, Indoor Air Quality

3 hours duration

NOTES

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a Closed Book Exam with a candidate prepared $8\frac{1}{2}$ " x 11" double sided Aid-Sheet allowed.
3. Candidates may use one of two calculators, the Casio or Sharp approved models. Write the name and model designation of the calculator on the first inside left hand sheet of the exam work book.
4. Any five (5) questions constitute a complete paper. Only the first five (5) answers as they appear in your work book(s), will be marked.
5. Each question is worth a total of 20 marks with the section marks indicated in brackets () at the left margin of the question. The complete Marking Scheme is also provided on the final page. A completed exam consists of five (5) answered questions with a possible maximum score of 100 marks.

Problem 1

Provide answers to the following questions related to *elements of indoor air quality* and *physical/ chemical characteristics of contaminants*.

- (15) (i) With reference to elements of indoor air quality (e.g., source of contamination, HVAC, pollutant pathways) identify two (2) important physical/chemical characteristics of two (2) contaminants. For each contaminant and characteristic provide engineering methods (**four (4) in total**) that if properly designed should improve the indoor air quality. Use a table to organize your answer.
- (5) (ii) Briefly explain two (2) important maintenance factors for engineering equipment used to control physical/chemical contaminants and promote continuous good indoor air quality.

Problem 2

Provide answers to the following questions related to *elements of indoor air quality* and *health effect*.

- (15) (i) Explain how mould may develop in a building, its potential health effects and two (2) engineering solutions that when properly designed should prevent or minimize the development and growth of mold in a building.
- (5) (ii) Briefly explain how humidity in a building may affect the indoor air quality and be a cause for concern.

Problem 3

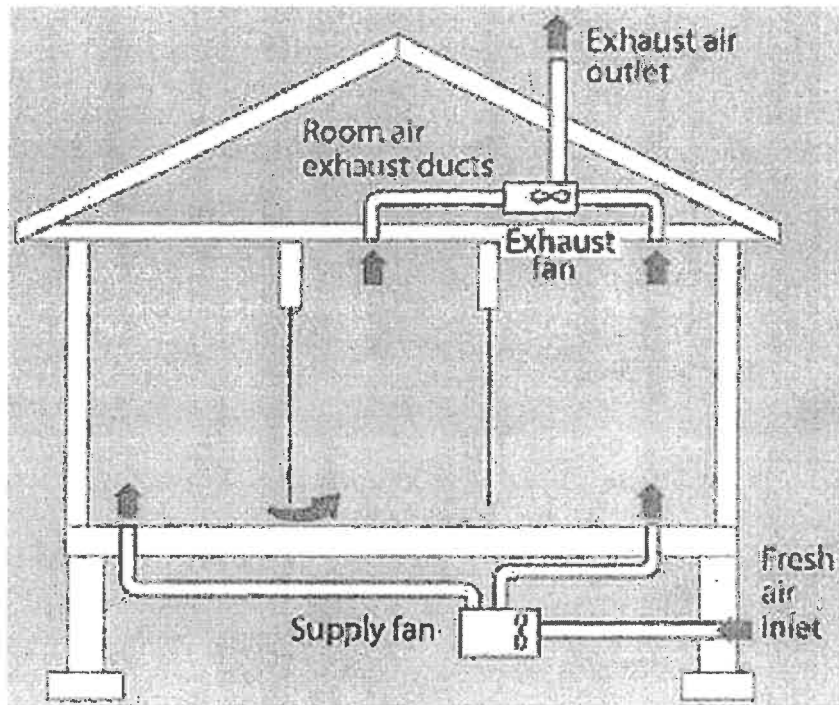
Provide answers to the following questions related to *estimation of the levels of indoor air contaminants in buildings*.

- (10) (i) Sensors are now readily available that can measure temperature, humidity, and detect CO₂ (IR absorption) and now metal oxide gas sensors that detect VOCs are also available. Select one (1) type of sensor with one (1) appropriate indoor air contaminant and explain the operating principle of the sensor to provide an estimate of the concentration level of the contaminant present in its vicinity.
- (10) (ii) Describe two (2) estimation techniques used to determine levels of two (2) different contaminants that are known to have an adverse impact on indoor air quality.

Problem 4

Provide answers to the following questions related to *design of ventilation systems for pollutant control*.

- (10) (i) There are three basic types of ventilation systems: (1) exhaust only; (2) supply only and (3) balanced supply and exhaust systems. Select one (1) type of system and explain how three (3) specific design aspects control pollutant buildup within a building.
- (10) (ii) Describe how any three (3) aspects of a well balanced ventilation system can help reduce indoor air pollutants. Consider the figure below in providing your answer.



Problem 5

Provide answers to the following questions related to *air pollution due to outdoor air supply through ventilation systems*.

- (10) (i) Provide an example of air pollution due to outdoor air supplied through a poorly designed ventilation system (VS). What are two (2) improvements that can be made to the existing VS to improve the indoor air quality?
- (10) (ii) Explain how the proper design, maintenance and operation of a VS can promote good indoor air quality despite the presence of outdoor air pollution.

Problem 6

Provide answers to the following questions related to *effect of outdoor air pollution on indoor air quality*. It's been reported that about 15% of indoor air quality problems are caused by outdoor air pollution sources.

- (8) (i) Explain two (2) methods by which outdoor air pollution increases indoor air pollution and provide one (1) method that can be engineered to help improve indoor air quality.
- (6) (ii) One way of quantitatively ensuring good quality indoor air is by the frequency of effective turnover of interior air by replacement with outside air. In Canada for example, classrooms are required to have 3 outdoor air changes per hour. Briefly explain the effectiveness of this strategy if outdoor air pollution is present.
- (6) (iii) Explain how "demand controlled ventilation" may be implemented to improve indoor air quality in a building even under conditions where outdoor air is polluted above the levels found inside a building.

Problem 7

Provide answers to the following questions related to *elements of indoor air quality and standard requirements*.

- (7) (i) The federal government recommends that you measure the level of radon in your home and sets specific standards. Provide three (3) reasons why the federal recommendations should be adhered to.
- (7) (ii) The federal government recommends that homes be weatherized in order to reduce the amount of energy needed for heating and cooling. While weatherization is underway, however, steps should also be taken to minimize pollution from sources inside the home. Provide two (2) potential indoor sources of air pollutants and give two (2) ways these sources can be minimized.
- (6) (iii) Provide an example of a municipal, provincial or federal standard (excluding Radon) that helps to reduce associated risks of exposure to poor indoor air quality. Explain how enforcement of this standard would work in cases where a building landlord is not complying with the set standard.

Marking Scheme

1. (i) 15 (ii) 5 marks, 20 marks total
2. (i) 15 (ii) 5 marks, 20 marks total
3. (i) 10 (ii) 10 marks, 20 marks total
4. (i) 10 (ii) 10 marks, 20 marks total
5. (i) 10 (ii) 10 marks, 20 marks total
6. (i) 8 (ii) 6 (iii) 6 marks, 20 marks total
7. (i) 7 (ii) 7 (iii) 6 marks, 20 marks total