Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	AIR POLLUTION PREVENTION AND CONTROL
COURSE CODE	:	BFA 40503
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	1.	ANSWER ALL QUESTIONS
	2.	THE FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK.**
	3.	STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Explain **FIVE (5)** activities in your locality that contribute to air pollution.

(10 marks)

(b) Discuss the future alternative sources of energy for light, heat and power.

(5 marks)

(c) The exhaust gas from an automobile contains 1.5 percent by volume of carbon monoxide (CO). The molecular weight of CO is 28.0 g/mole. Calculate:

(i) The concentration of CO in milligrams per cubic meter (mg/m^3) at 25^0C and 1 atm pressure. Assume 1 percent by volume = 1 percent by moles = 10^4 ppm.

(5 marks)

(ii) The concentration in $\mu g/m^3$ in the exhaust pipe if it is at 200^0C and 1.1 atm of pressure. Assume the constant in the denominator is 22.41 at 0^0C (273^0K) and 1 atm.

(5 marks)

Q2 (a) Explain why air pollution monitoring should complement air pollution modelling.

(5 marks)

(b) It is stated that if all the vehicles including trains run on electricity in a country, it may solve the air pollution problem in local areas, but it may have adverse environmental effects in other locations. Discuss.

(5 marks)

(c) A coal burning electric generating plants emits 1.1 kg/min of Sulfur Dioxide (SO_2) from a stack with an effective height 60 m. On a thinly overcast evening, with a wind speed of 5 m/s, calculate:

(i) The ground level concentration of SO_2 500 m directly downwind from the stack.

(5 marks)

(ii) The ambient ground level concentration at 200 m downwind along the plume centerline. The emission consists of particles 10 µm in diameter, a density of $1 g/cm^3$and the viscosity of the air is 0.0185 g/m-s at 25^0C.

(8 marks)

(iii) The deposition rate at 200 m downwind along the plume centerline.

(2 marks)

Q3 (a) With neat sketches, describe **FIVE (5)** types of plume behaviour.

(5 marks)

(b) Explain the potential impacts of global warming on coastal and agricultural areas.

(5 marks)

(c) International attempts to limit carbon dioxide emissions have included meetings between countries in Kyoto in 1997, Copenhagen in 2009 and Cancun in Mexico in 2010. They have had only limited success. Briefly explain the reasons why international action to reduce carbon dioxide emissions has been much slower than many environmental groups would have liked.

(5 marks)

(d) Consider non-absorbing particles of 1.0 μm diameter with a refractive index of 1.33 suspended in air and exposed to daytime radiation. The density of the particles is taken to be 1.5 g/cm^3. The wavelength of visible light can be taken to be 0.48 μm. Calculate:

(i) The concentration of particles in micrograms per cubic meter which results in a limit of visibility of 1.6 km.

(5 marks)

(ii) The concentration of suspended particles if the effective diameter is 0.5 μm and the visibility is 8.05 km.

(5 marks)

Q4 (a) Discuss the extend usefulness of dissemination by the media of the Air Quality Index (AQI) values in the communities in which you have lived.

(5 marks)

(b) Explain an example of a company in your country that has turned an environmental problem into a profit and discuss the major drivers and the obstacles that had to be overcome.

(10 marks)

(c) An activated carbon bed used to control an air stream with a flowrate of 20 m^3/min at 25^{0}C at a pressure of 1 atmosphere. The air contains 850 ppm of monochlorobenzene (C_6H_5Cl). The bed is 0.5 m deep, operates at a superficial face velocity of 0.4 m/s and contains activated carbon with a bulk density of 400 kg/m^3 of bed. Assuming that the working adsorption capacity of the bed is 40% of the adsorption capacity. Determine:

(i) The working adsorption capacity of the carbon.

(3 marks)

(ii) The physical dimensions of the activated carbon bed if the cross-sectional length (L_c) is equal to two times the width (W).

(3 marks)

(iii) The mass of activated carbon in the bed.

(2 marks)

(iv) The time in minutes required to reach breakthrough if it is assumed that the adsorption wave is vertical and that saturation occurs when the working adsorption capacity has been reached.

(2 marks)

- **END OF QUESTIONS** -