

M505: CONTROL OF HAZARDOUS SUBSTANCES

CALCULATION EXERCISES

QUESTION 1

The velocity of air moving in ductwork is 30 ms^{-1} . What is the velocity pressure?
(Assume standard temperature and pressure)

QUESTION 2

Air is passing through a duct of cross-sectional area of 0.04 m^2 at a rate of $1 \text{ m}^3\text{s}^{-1}$. If the static pressure is -300 Pa , what is the total pressure in the duct?
(Assume standard temperature and pressures)

QUESTION 3

A worker spills 100 g of toluene in an unventilated room of dimensions 10 m x 3 m x 10 m. Assuming perfect mixing, what is the concentration in the room?

QUESTION 4

A Laboratory fume cupboard is regularly tested as part of the site maintenance procedures. The fume cupboard has dimensions of 1.2 m x 0.6 m and the diameter of the circular duct to the fan is 200 mm. Given the face velocities of the fume cupboard (Table 1), what is the average air velocity in the duct?

Table 1 – Face Velocities of Fume Cupboard

Measurement No.	Face Velocity (ms^{-1})
1	0.15
2	0.24
3	0.21
4	0.19
5	0.18
6	0.13
7	0.20
8	0.18
9	0.17
10	0.19
11	0.24
12	0.20
13	0.18
14	0.17
15	0.15
16	0.16

QUESTION 5

Air enters an ideal 12 cm diameter plain duct hood and has a volume flow rate of $0.22 \text{ m}^3\text{s}^{-1}$. What is the approximate velocity 12 cm from the end of the duct?

QUESTION 6

Complete the calculations on the pitot traverse worksheet of a 0.6 m round duct.

PITOT TRAVERSE WORKSHEET						
Date:		Time:		P_s:		-630 Pa
Temp:				Description:		Round/Galvanised
Equipment:		Main Duct		Location:		Furnace No. 3
	Vertical			Horizontal		
	P_T	P_V	V (ms⁻¹)	P_T	P_V	V (ms⁻¹)
1	180			155		
2	260			230		
3	270			265		
4	285			280		
5	300			295		
6	300			315		
7	270			285		
8	280			255		
9	240			245		
10	165			185		
Average Velocity Pressure = Average Velocity = Volume Flow Rate =						

Why are the velocity pressure readings lower at the extremes of the traverse?

QUESTION 7

A workshop with a volume of 623 m³ is contaminated with carbon monoxide such that the concentration reaches 1500 ppm. The workshop is ventilated for 15 minutes by dilution ventilation at a rate of 0.944 m³s⁻¹. What would you expect the concentration of carbon monoxide to be in the workshop after ventilation, assuming good mixing?