

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2023

Programme Name: B. Tech. in CE+RP

Semester : VII

Course Name : Chemical Process and Plant Safety

Time : 3 hrs

Course Code : CHCE 3015P

Max. Marks : 100

Nos. of page(s) : 2

Instructions : Attempt all questions. Assume any missing data with proper justification.

S. No.		Marks	CO																						
	Section A																								
Q 1	What do you understand from "Fire Triangle". Give any two examples of fire triangle.	10	CO1																						
Q 2	What are the hazard identification methods. Draw a neat diagram showing hazard identification and risk assessment procedure.	10	CO1																						
Q 3	Discuss the effect of different parameters which influence the dispersion of toxic materials.	10	CO2																						
Q.4	Why the installation of pressure relief devices is important from a safety perspective? Discuss relief types and their characteristics.	10	CO2																						
Q.5	A gasoline tank in a standard automobile contains about 14 gal of gasoline and can be filled in about 3 min. The molecular weight of gasoline is approximately 94, and its vapor pressure at 77°F is 4.6 psi. Estimate the concentration (in ppm) of gasoline vapor because of this filling operation. Assume a ventilation rate of 3000 ft ³ /min. The TLV for gasoline is 300 ppm. State any assumption made to solve this problem.	10	CO3																						
Q.6	<p>The TLV-TWA for a substance is 150 ppm. A worker begins a work shift at 8 A.M. and completes the shift at 5 P.M. A one-hour lunch break is included between 12 noon and 1 P.M., where it can be assumed that no exposure to the chemical occurs.</p> <p>The data were taken in the work area at the times indicated. Has the worker exceeded the TLV specification?</p> <table border="1"><thead><tr><th>Time</th><th>8:10 AM</th><th>9:05 A.M.</th><th>10:07 A.M.</th><th>11:20 A.M.</th><th>12:12 P.M.</th><th>1:17 P.M.</th><th>2:03 P.M.</th><th>3:13 P.M.</th><th>4:01 P.M.</th><th>5:00 P.M.</th></tr></thead><tbody><tr><th>Concentration (ppm)</th><td>110</td><td>130</td><td>143</td><td>162</td><td>142</td><td>157</td><td>159</td><td>165</td><td>153</td><td>130</td></tr></tbody></table>	Time	8:10 AM	9:05 A.M.	10:07 A.M.	11:20 A.M.	12:12 P.M.	1:17 P.M.	2:03 P.M.	3:13 P.M.	4:01 P.M.	5:00 P.M.	Concentration (ppm)	110	130	143	162	142	157	159	165	153	130	10	CO3
Time	8:10 AM	9:05 A.M.	10:07 A.M.	11:20 A.M.	12:12 P.M.	1:17 P.M.	2:03 P.M.	3:13 P.M.	4:01 P.M.	5:00 P.M.															
Concentration (ppm)	110	130	143	162	142	157	159	165	153	130															

Section B

<p>Q.7</p>	<p>On an overcast day a stack with an effective height of 60 m is releasing sulphur dioxide at the rate of 80 gals. The wind speed is 6 m/s. The stack is in a rural area. Determine</p> <p>a. The mean concentration of SO₂ on the ground 500 m downwind.</p> <p>b. The mean concentration on the ground 500 m downwind and 50 m crosswind.</p> <p>c. The location and value of the maximum mean concentration on ground level directly downwind.</p>	<p>20</p>	<p>CO4</p>
<p>Q.8</p>	<p>La La Pharmaceuticals has recently discovered a new drug, Lalone, in their chemical laboratories. Lalone is expected to be a blockbuster drug, raking in billions of dollars each year. For the next stage of clinical studies over 50 kg of Lalone is required, and La La Pharmaceuticals has decided to produce this in their existing pilot plant operations in Lala Land. As the safety director for the pilot plant operations, you oversee ensuring the safety of all operations.</p> <p>During a meeting with the chemist who synthesized Lalone in the laboratory, you have learned the following: (1) Lalone is a fine, white powder; (2) Lalone is synthesized by a batch process through a series of four major steps - three sets of reactions to produce intermediates, followed by drying to produce Lalone (all reactions are carried out in the liquid phase and require acetone as a solvent); (3) the chemical reactions are not understood, and most physical and chemical properties are not known; (4) so far, Lalone has been manufactured only in the laboratory and in small quantities (less than 50 g); (5) management wants the pilot plant operations to be started as soon as possible. and (6) the Engineering Division has already started writing the operating procedures for the eventual process. Answer the following.</p> <p>a. Based on your safety knowledge and experience, identify the major hazards in this process that you would be concerned about.</p> <p>b. Describe how you would structure a hazard study for the Lalone manufacturing process.</p> <p>c. What additional information will you need to conduct the hazard analysis study?</p>	<p>20</p>	<p>CO4</p>