

Name: _____

Section: _____

March 9, 2022,

Full Marks: 100

- Please mark your answers clearly and write legibly in open-ended answers. Write your name (as appears on canvas.) in every page of the exam
- You may answer directly on this exam sheet (preferred) or alternatively use the answer sheet (or similar format) to submit your answers.
- Submit your exam in a **single pdf file**. Consider the time required to convert the file/scan/upload before. Once the canvas link closes you will not be able to submit your exam

An Aggie does not lie, cheat, or steal or tolerate those who do

I acknowledge I have read and will follow the instructions and will adhere to the Aggie Honor Code:

Signature: _____

1.	Risk is defined as the product of facility size and incident likelihood.	(True/False)	(2)
2.	The conceptual design phase is the first phase of the plant life cycle.	(True/False)	(2)
3.	Fault tree analysis (FTA) is one of the PHA study methodologies.	(True/False)	(2)
4.	Preliminary hazard analysis (PHA) fails to identify system level hazards.	(True/False)	(2)
5.	Purpose of <i>What-if</i> analysis is to identify problems that could lead to incidents.	(True/False)	(2)
6.	<i>What-if</i> analysis team uses a predefined question set rather than questions generated by the team members.	(True/False)	(2)
7.	OSHA provides incident rate formulas that can be used to compare a company's safety performance to others.	(True/False)	(2)
8.	Injury rates tend to reflect the potential severity of an event rather than the likelihood.	(True/False)	(2)
	Which one of the following systems is not an engineered system?		(2)
9.	a. Chemical process plant b. Amazon rainforest c. Road traffic system d. Airplane		
10	Which one of the following has not been a safety moment presented in class?		(2)
	a. Fire extinguisher safety b. Jaywalking c. Incident case study d. Carbon monoxide hazards		

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11. Which one of the following choices correctly defines *hazard*? (4)

- a. Any potential condition that can cause injury, illness, or death or damage to or loss of a system, equipment or property or damage to the environment
- b. An undesirable and unexpected incident
- c. An incident that causes greater damaged than anticipated
- d. An expression of probability of occurrence of an undesired incident

12. Give four examples of ways to apply the 5 questions of risk to a PHA technique (like HAZOP) (4)

- 1.
- 2.
- 3.
- 4.

13. Which one of the following choices is **not** used as a counter-measure for risk reduction? (4)

- a. Design change
- b. Salary incentives
- c. Safety feature
- d. Warning devices

14. Which of the following is **not** a risk ranking category that is used? (4)

- a. Negligible risk
- b. Unidentifiable risk
- c. Major risk
- d. Unacceptable risk

15. Which one of the following is **not** a goal of risk assessment? (4)

- a. Replace opinion with consensus of a group assessment process
- b. Formalize / adopt a systematic approach to resolving issues
- c. Make risks seem less severe than they actually are
- d. Identify and prioritize hazards

16. Procedures and training can reduce (4)

- a. Severity of the incident
 - b. Probability of occurrence of the incident
 - c. Both (a) and (b)
 - d. None of the above
-

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17. What is the formula for determining deviations of concern in a HAZOP? (4)

- a. Deviation = Rate of Change + Units
- b. Deviation = Parameter + Guide Word
- c. Deviation = Hazard + Location
- d. Deviation = Risk + Mitigation Strategy

18. What is a difference between risk and uncertainty? (4)

- a. Risk involves chemical facilities while uncertainty involves other types of industrial facilities
- b. Risk involves people while uncertainty involves equipment
- c. Risk involves monetary losses while uncertainty does not
- d. Risk is quantifiable while uncertainty is not

19. Based on the E. I. DuPont De Nemours Co. Fatal Hot work Explosion in Buffalo, specify **a)** the system that failed and **b)** what could have been done differently to prevent this incident? (4)

a)

b)

20. Please fill out the gaps in the following table: (4)

Severity Category		
Category	Name	Characteristics
I	Catastrophic	Death Loss of system
II		Severe injury or morbidity Major damage to system
III	Marginal	
IV	Negligible	No injury or morbidity No damage to system

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20. What are the five questions of risk? (7)

- 1)
- 2)
- 3)
- 4)
- 5)

21. List two (2) types of “information needs” in order to address deviations of concern. (2)

- 1)
- 2)

22. List three (3) hazard analysis techniques. (3)

- 1)
- 2)
- 3)

23. Other than flow, list three (3) parameters that may be included in a HAZOP (6)

- 1)
- 2)
- 3)

24. For the parameter ‘flow’, list three (3) guide words that may be associated with it when completing a HAZOP. (6)

- 1)
 - 2)
 - 3)
-

EXAM – 1

Name: _____

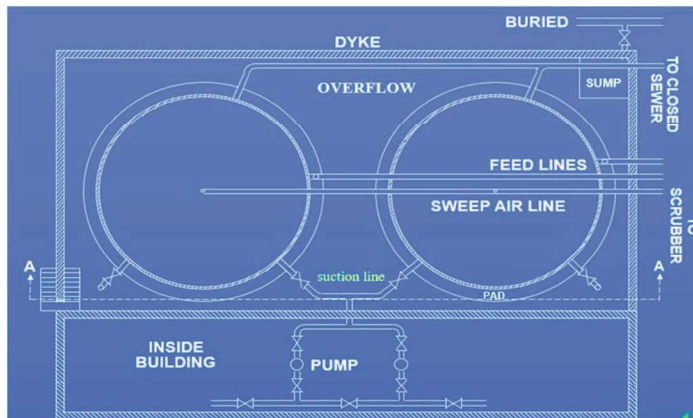
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25. For the risk matrix below, list three (3) cells that would typically be in the 'unacceptable' category (i.e. shaded red). (Type the scenario Severity and Likelihood e.g., 6-A)

Risk Ranking						
Severity	5	5A	5B	5C	5D	5E
	4	4A	4B	4C	4D	4E
	3	3A	3B	3C	3D	3E
	2	2A	2B	2C	2D	2E
	1	1A	1B	1C	1D	1E
		A	B	C	D	E
	Likelihood					

- 1) 2) 3)

26. Prepare three (3) *what-if* questions on the ClO_2 storage tanks at the pulp mill as shown in the following figure. (**Questions only**, no additional information is required) (10)



- 1)
- 2)
- 3)

- 27. Bonus Question** (+5 pts)

Risk can be defined as “Capital staked under conditions of uncertainty”. How would you interpret this definition?