

UNIT 2: Principles and Applications of Science and Technology in Safety

Total Time: 5:00 hours

Total Questions: 15

Total Marks: 150

Passing Marks: 75

- This is a closed book exam. The maximum marks for each question are 10.
 - Answers may be illustrated by sketches or process flow diagrams where appropriate.
 - This question paper & answer sheets must be returned to the invigilator after the examination.
 - Support your answers with **logical arguments** and **examples**. Generic and Bookish answers will not be accepted by the examiners.
 - All Questions are compulsory and must be answered to gain maximum marks
 - Use bullet points for questions asking to **Outline** and make sure each bullet point has unique and valuable content. You must give examples for each bullet point to clarify your answer.
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Part A

(Each Question carries 10 Marks)

- 1- You are working in a company which is involved in manufacturing and installation of telecom towers. Working at height has been assessed as the key process and you as safety engineer has been tasked by the management to devise engineering controls for the safety of people working at height.
Suggest 3 different engineering controls for work at height safety and also explain if they will reduce/eliminate likelihood or severity or both?
- 2- You are working in a surface treatment plant where number of chemical processes are carried out. Due to the presence of chemicals, there are airborne chemicals at the workplace which have lately caused ill health issues to the workforce. The management wishes to take measures to eliminate/ reduce ill health effects due to airborne chemicals.
Outline in a step by step process how will you carry out the control measures?
- 3- Your company houses 2 boilers (Old/ repaired and modified) which are used to produce steam. During your visit as safety manager to the boilers site, you notice that boiler operations are manual. There is a pressure gauge installed on each boiler and once a threshold pressure is reached, an alarm rings and the operator adjusts the setting to bring down into the safe range. The situation is a matter of concern as it is dependent on the vigilance of the operator and may cause boiler explosion. You discussed the issue with the top management who tasked you to devise an engineering control through a sub-contractor.
Explain the features of proposed engineering control you wish to suggest which will reduce/eliminate the likelihood of the hazard.
- 4- LTEL of H₂S gas is 10 ppm/ 8 hrs and STEL is 15ppm/ 15 min. Please analyse the following exposure data for employees and comment if **STEL** and **LTEL** limits are being complied or not? Also calculate the **TWA**.

Morning shift 0800 to 1600 hrs (8am to 4pm)

Time	8 to 9	9 to 9:40	9:40 to 10:15	10:15 to 11	11 to 1:00	1:00 to 1:45	1:45 to 4
Exposure	12 PPM	18 PPM	11 PPM	9 PPM	14 PPM	14.5 PPM	14 PPM

- 5- You have been tasked as investigation officer by the regulatory body subsequent to a boiler explosion at a factory. **Develop a checklist** of at least 10 suitable questions you wish to ask the user agency to identify the root cause of collapse. Your checklist must be in the following format;

Sr#	What to Ask (Look Into)	Why to Ask?(Look For)

Part B
(Each Question carries 10 Marks)

- 6- **Outline** the selection consideration for monitoring and measuring devices for a workplace having airborne chemical?
- 7- **Explain** various mechanical properties of materials and identify which properties are desired in the materials and which properties are not desired?
- 8- **Explain** why studying various forms of energy is important from occupational safety and health perspective. Give suitable examples?
- 9- **Explain** the working principle of a screw jack and how it can be used to lift heavy loads by a single person?
- 10- **Outline** the reasons and contributory factors for material failures?
- 11- **Outline** the control measures for working on live electrical equipment?
- 12- **Outline** the product designers' limitations to eliminate OHS hazards from the tools & equipments?
- 13- **Explain** how "Earthing" can be effective against the risk of electrocution?
- 14- **Outline** the "**Factors**" you will consider in a Fire Risk Assessment?
- 15- **Explain** how car seat belt works during the collision and saves you?

(End of Question Paper)