DEPARTMENT OF CHEMISTRY

UNIVERSITY OF SWAZILAND

CHE 211 GOOD LABORATORY PRACTICE AND MANAGEMENT

DECEMBER 2017 FINAL EXAMINATION

Time Allowed: Three (3) Hours

Instructions:

1. **This examination has six (6) questions. The total number of pages is four (4), including this page.**
2. **Answer any four (4) questions fully; diagrams should be clear, large and properly labelled. Marks will be deducted for improper units and lack of procedural steps in calculations.**
3. **Each question is worth 25 marks.**

Special Requirements

None

YOU ARE NOT SUPPOSED TO OPEN THIS PAPER UNTIL PERMISSION TO DO SO HAS BEEN GIVEN BY THE CHIEF INVIGILATOR.

Question 1 [25]

(a) A Risk and Hazard Assessment is a tool for good laboratory practice and management. What activities are carried out during this kind of assessment? (5)

(b) Apart from fires, a Risk and Hazard Assessment will reveal other dangers associated with the chemistry laboratory.

(i) What does the acronym MSDS mean in risk assessment (1)

(ii) Explain how MSDS's are useful in risk assessment in the chemistry laboratory (3)

(c) What is the symbol for each of the following in the MSDS:

i) Flammable (2)

ii) Carcinogenic (2)

iii) Explosive (2)

iv) Poisonous (2)

(d) Chemically, how do the following concentrated acids pose safety hazards in the laboratory, and what precautions must be taken during their use.

i) H_2SO_4 (2)

ii) $HClO_4$ (2)

iii) HF (2)

iv) HNO_3 (2)

Question 2 [25]

a) Give the official definition of a Good Laboratory Practice (GLP) in non-clinical laboratories. (2)

b) Like in all science and engineering fields, the chemistry laboratory has its own unique "tools of the trade". What criteria would you use to choose each of the following glassware for volumetric analysis:

i) measuring cylinder *versus* transfer pipette (4)

ii) weighing scale *versus* analytical balance (4)

c) When designing the chemistry laboratory, what considerations must be made for the weighing room? (3)

d) Draw the schematic of an analytical balance and explain in each case how it works. (6)

e) What health risks do the following pose in the chemistry laboratory, and how are they managed and disposed of

(i) broken glass (3)

(ii) bloodied bandages (3)

Question 3 [25]

a) ISO is the international standards body that has issued ISO 17025

(i) What is a standard? (3)

(ii) Why are standards important for Good Laboratory Practice (GLP) and Management? (4)

(iii) Briefly outline the principles of ISO 17025 as the basis of good laboratory practice. (5)

b) In the laboratory, what safety risks are posed by the following, and how are the risks minimized during storage.

(i) Hexane solvent (3)

(ii) Acetylene cylinders (3)

c) In the laboratory, what environmental and health risks are posed by the following, and how are the risks minimized when disposing of them

(i) Cadmium (3)

(ii) Hexavalent chromium (3)

d) In the laboratory, what security risks are posed by trinitrotoluene? (1)

Question 4 [25]

(a) The handling and disposal of wastes is a component of good laboratory practice and management in a chemistry laboratory.

i) Explain why NO_3^- and PO_4^{3-} salts and solution wastes should not be thrown down the drain in the laboratory. How are they disposed of? (6)

ii) Explain why mercury spilled from broken thermometers is dangerous to human health. How are mercury spills handled and disposed of? (6)

(b) In the chemistry laboratory, LIMS has hardware and software components that are useful, but over the years have generated e-waste.

i) what does the acronym "LIMS" stand for in the chemistry laboratory? (1)

ii) how has LIMS contributed to good laboratory management (4)

iii) what is meant by e-waste? (1)

iv) how has LIMS contributed to the generation of e-waste from the chemical laboratory (3)

v) how is e-waste emanating from the implementation of LIMS in the chemistry laboratory managed and disposed of? (4)

Question 5 [25]

(a) The chemistry laboratory must not only manage chemical hazards, but also physical hazards.

(i) Why is the noise hazardous to human health? (2)

(ii) Why is dust hazardous to human health? (2)

(a) For any of three (3) personal protective equipment (PPE) used in the chemistry laboratory, describe why it should be used as a matter of " best practice". (6)

(b) The use of chrysolite for roofing and water pipelines in the chemistry laboratory is no longer a design option. Explain why (4)

(c) When working in the fume hood with radiation sources, additional shielding is required.

(i) Give an example of a radiation source in the chemistry laboratory using an equation to illustrate (4)

(ii) What is the symbol for radiation sources in the Material Safety Data Sheet (2)

(iii) Give an example of a material commonly used as a shield for radiation sources in the chemistry laboratory (1)

(iv) How is radioactive waste managed and disposed of in the chemistry laboratory (4)

Question 6 [25]

(a) Give the official definition of the Scientific Method of Investigation (2)

(b) Discuss three main barriers to good laboratory designs. (6)

(c) Describe each of the three (3) main stages involved in the design of a chemistry laboratory (6)

(d) Chemistry laboratories have standard equipment and common reagents. Explain in detail, using diagrams and/or equations, how each of the following are produced in the laboratory

(i) Distilled water (4)

(ii) Deionized water (4)

(iii) Aqua regia (3)