NATIONAL UNIVERSITY OF LESOTHO

FACULTY OF HUMANITIES

COMMUNICATION AND STUDY SKILLS UNIT

ELG1313: COMMUNICATION AND ACADEMIC LITERACY FOR SCIENCE AND TECHNOLOGY

JANUARY 2024 MARKS: 100 TIME: 3HOURS

INSTRUCTIONS:

- **ANSWER ALL QUESTIONS**
- **BEGIN EACH QUESTION ON A FRESH PAGE**
- **WRITE YOUR STUDENT NUMBER AND GROUP CLEARLY**
- **WRITE LEGIBLY**

QUESTION 1: ESSAY WRITING

Read the passages below and use information from them to write a **Descriptive Essay** on the following title: [60]

The Role of Laboratory Experiments in Science Education

- Length of the essay is 1 ½ - 2 pages including bibliography
- Include 2 direct quotations and 3 or more indirect quotations in your essay.
- Marks will be awarded for the following:
    - appropriate content
    - correct grammar and spellings
    - academic style
    - good paragraphing
    - quoting and bibliography skills

Passage 1

The Effect of Guided-Inquiry Laboratory Experiments on Science Education

Laboratory practice has unquestionable importance in chemistry education. In effective chemistry education, theoretical explanations should be supported by laboratory applications. The aims of laboratory work can be listed as developing understanding related to the scientific content, problem solving skills; science processes skills and understanding the nature of science. Students are expected to realize the connection between experiments and scientific theory. While solving a scientific problem, students should act like a scientist and follow

scientific processes. By scientific inquiry, students determine the problems, develop solutions and alternative solutions for these problems, search for information, evaluate the information and communicate with their friends.

But traditional laboratory does not allow this. The traditional laboratory format is called as "expository laboratory", "cook-book style laboratory" and "verification laboratory". Today, traditional laboratory method is being used widely. Traditional labs only focus on scientific terminology, concepts and facts and they contain detailed procedures and tell students what they will observe during experiments. In this method, students follow instructions written in the lab manual step by step and the outcome is pre-determined. Students already know the scientific theory when they start doing their experiments. In this format, students only think about following the directions written in the lab manual. For this reason, students cannot develop higher order cognitive skills.

Despite traditional laboratory method having some advantages like conducting many experiments in crowded classes within a limited time and using limited sources, this method has many disadvantages. Students often cannot learn effectively since they just concentrate on the lab manual and they generally do not have real life connections. In traditional laboratory, students' ability to follow instructions has been considered instead of their questioning, designing, conducting and analysing an experiment. The most important negation of cook book style laboratory is it does not help students translate scientific outcomes into meaningful learning. Traditional laboratory method is inadequate for supporting the development which is aimed by laboratory.

Changes in lab style can help students develop scientific processing skills and understand the nature of science. Teachers should move away from traditional lecturing and cookbook style laboratories to active learning strategies such as problem based learning, cooperative learning and inquiry based learning which help students to develop their cognitive processes and help them to become lifelong learners. Inquiry based learning supports that students apply their knowledge, understand real world situations and supports discovery. Inquiry based learning help educators to increase students' self-confidence and learning. Students need to develop scientific inquiry skills while learning scientific facts and principles. In inquiry based learning environments, students are more active and they guide their own learning processes. Inquiry based laboratory requires students to search for knowledge, generate hypothesis, collect data, interpret evidence and make conclusions. In this laboratory method, students can design their

own experiments and instead of following a verification process, they try to reach the scientific concepts by themselves and they develop higher order cognitive skills.

Source: The Effect of Guided-Inquiry Laboratory Experiments on Science Education, Martins, R., 2024. Morija, Maseru

Passage 2

Laboratory experiments: understanding their roles in education

Science is the study of facts. At the same time, science is also about discovering the world around, of knowing things, and having new and wonderful ideas. It is against this very definition of science that most educators believe that scientific learning that takes place in classrooms alone is not true learning. For fostering scientific learning, active hands-on learning is very important. This can best be achieved through science lab experiments.

Science lab experiments promote the development of scientific thinking in students. Rather than making the students memorize the facts, they are made to think and understand things and the world around them. Science lab experiments allow students to ask questions, probe for answers, conduct investigations, and collect data. They are engaged in the investigative nature of scientific learning. Students in fact do science in science labs than simply learning science through textbooks in classrooms.

Science experiments promote discovery and learning. Discovering new ideas is an integral part of learning science. It is something that teachers cannot give to students. Students themselves have to discover new ideas and concepts during their search for knowledge. In science school lab, students conduct experiments. They adopt alternatives, try to work out things in different areas and understand what works and what does not really work. Many a times, students work on wrong ideas. But it is only when they work on the wrong ideas that they understand the real ideas in a much better manner.

Source: https://www.scientificinfo.edu.com, 2019. Laboratory experiments: understanding their roles in education. Seeiso,L. [Accessed on 18-12-2023]

Passage 3

The History of the Laboratory in Chemistry Education

Throughout this book we use the terms practical work, which is common in the UK and Germany, and laboratory work, common in the USA, interchangeably. A precise definition is difficult, as this in-school practice embraces an array of activities, but the terms generally refer to experiences in school settings in which students interact with equipment and materials or secondary sources of data to observe and understand the natural world (Hegarty-Hazel, 1990). For the purpose of this book, laboratory activities are defined as contrived learning experiences in which students interact with materials and equipment to observe phenomena. This book focuses on teaching and learning in the high school chemistry laboratory. In chemistry learning, the laboratory provides opportunities to 'learn by doing' to make sense of the physical world. Since the 19th century, science educators have believed that laboratory instruction is essential because it provides training in observation, prompts the consideration and application of detailed and contextualized information, and cultivates students' curiosity about science.

Laboratory activities have long had a distinct and central role in the science curriculum as a means of making sense of the natural world. Since the 19th century, when schools began to teach science systematically, the laboratory has become a distinctive feature of chemistry learning. After the First World War, and with rapidly increasing scientific knowledge, the laboratory was used mainly as a means of confirming and illustrating information previously learnt in a lecture or from textbooks. With the reform in science education in the 1960s in many countries (e.g., CHEMStudy in the USA and Nuffield Chemistry Program in the UK), the idea of practical work was to engage students in investigations, discoveries, inquiry and problem-solving activities. In other words, the laboratory became the core of the science learning process (Shulman and Tamir, 1973).

Based on a thorough review of the literature, Shulman and Tamir (1973) suggested the following classification of goals for laboratory instruction in the sciences: to arouse and maintain interest, attitude, satisfaction, open-mindedness and curiosity; to develop creative thinking and problem-solving ability; to promote aspects of scientific thinking and the scientific method; to develop conceptual understanding; and to develop practical abilities (for example, designing an experiment, recording data and analysing and interpreting results obtained from conducting an experiment). Hofstein and Lunetta (1982), suggested a method of

organizing these goals to justify the importance of laboratory teaching and learning, under the headings: cognitive, practical and affective.

Source: Advances in Chemistry Education Research. 2021. A. Hofstein and M. Hugerat. Royal Society of Chemistry. Manchester.

QUESTION 2: READING COMPREHENSION

Read the following passage and answer the questions that follow.

Historical perspective of laboratory work: Why have laboratories?

The first teaching laboratory in chemistry in Britain was established by Thomas Thomson in the University of Edinburgh in 1807. In 1819, he introduced this to the University of Glasgow, when he joined this University. In 1824, Liebig established a Chemistry Laboratory at the University of Giessen. Laboratory classes then gradually developed over the next fifty years until eventually, in 1899, it came to be considered necessary that school pupils be allowed to carry out experiments for themselves.

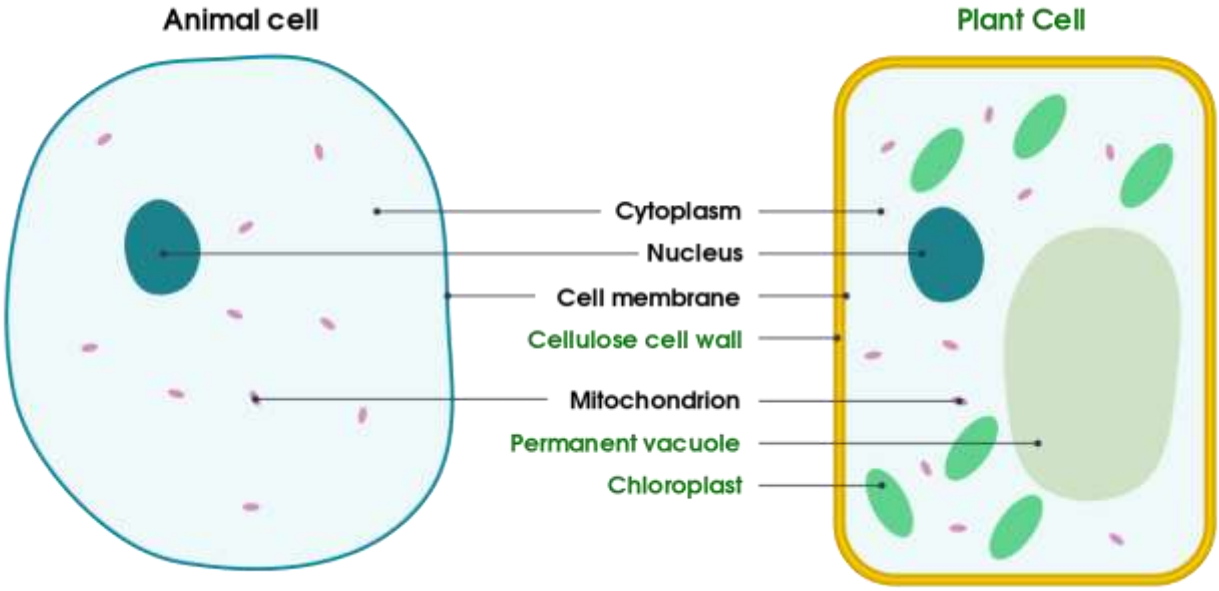
Laboratories are one of the characteristic features of education in the sciences at all levels. It would be **rare** to find any science course in any institution of education without a substantial component of laboratory activity. It is assumed to be necessary and important. One of the main reasons to question the place of laboratory teaching is that laboratory programmes are very expensive in terms of facilities and materials, but also, more importantly, in terms of staff time (Carnduff and Reid, 2003). University students' reactions to practical work are often negative, and this may reflect a student **perception** that there is a lack of any clear purpose for the experiments: they go through the experiment without **adequate** stimulation.

It is important to think about goals, aims and objectives in the context of laboratory work. Laboratory work here is used to describe the practical activities, which students undertake using chemicals and equipment in a chemistry laboratory. Of course, the word 'practical' can include other activities as well, and it is interesting to note the use of the word in so many titles in papers. Many years ago in a schools context, Rose and Seyse (1974) raised a **fascinating** question: could many important aims still be attained even if practical work were abolished? They suggested that this depends partly on our view of science. Science can be seen as established human knowledge, a problem solving activity, or concerned with the relation between theory and experiments. In some ways, this starts to define what could be the important

aims, which can be uniquely achieved through laboratory courses. Animal and plant cells shown in figure 1 below are also seen in the laboratory.

Source: By Reid and Shah (2007)

Figure 1: Animal and plant cells (Adapted from Wikimedia Commons)



Questions

a) What is science? (2)

b) Who is the pioneer in the teaching of laboratory in chemistry at the University of Edinburgh and the University of Glasgow? (2)

c) When and where did Liebig establish a Chemistry laboratory? (2)

d) Mention the challenge of implementing laboratory teaching. (2)

e) In your own words, explain how the university students react towards practical work. (2)

f) Can we conclude that laboratories are taught only at universities? Provide **two** points to support your answer. (5)

g) Figure 1 shows the structure of animal and plant cells. Write **two** similarities and **two** differences of the cells. (4)

h) Based on your Biology background and experience, name the instrument used to observe the cells, and state why it is used. (3)

i) In **not more than 100 words**, summarise the goals and objectives achieved through laboratory courses. (10)

j) Based on how the **bolded** words are used in the passage, provide their meaning. Their equivalent words should be a word or phrase of not more than **eight** words.

(i) Adequate

(ii) Rare

(iii) Perception

(iv) Fascinating (8)

[40]