



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of applied and health sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ANALYTICAL CHEMISTRY (DAC16S)

ACH 2108 LABORATORY PRACTICE-I

END OF SEMESTER EXAMINATION

SERIES:NOV/DEC 2016 PAPER-B

TIME:2HOURS

DATE: 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions.

Answer Question ONE (compulsory) and any other TWO Questions.

Do not write on the question paper.

Question ONE

- a)(i)Name specific needs to be considered when designing a process quality control laboratory 4 marks
- b) (i)State TWO precautions to observe when heating solution with a glassware 2 marks
(ii)Name the main types of balances 2 marks
- c) (i)List TWO types of barometer 2 marks
(ii)List TWO disadvantages of stills 2 marks
- d) Describe the mode of disposal of the following chemicals:
(i) Formaldehyde 2 marks
(ii) Hydrogen peroxide 2 marks
- e) (i)Explain the location of fume hood in laboratory 2 marks
(ii)Name TWO types of floor covering in the laboratory 2 marks
- f) Name FOUR impurities removed by distillation process 4 marks
- g)(i) State the factors which determine the choice of floor covering 2 marks
(ii)State TWO disadvantages of Canada balsam mounting media 2 marks
- h) Explain the meaning of differential media 2 marks

Question TWO

- a) Explain the recommendation for storage of hazardous materials 7marks
- b) Explain the working principle of Equal-arm balance

Question THREE

- a) Explain the working principle of a de-ionizer 8 marks
- b) Outline the differential properties of Eosin methylene blue agar

Question FOUR

- a) Outline the procedure to determine a corrosive waste chemical 7 marks
- b) Explain the procedure for mounting a slide with glycerol –jelly 8 marks

Question FIVE

- a) Explain the criteria used to discharge waste chemical down the drain 8 marks
- b) Describe the working principle of a galvanometer 7 marks

MARKING SCHEME PAPER-B

a) (i) items for consideration for a process quality control lab.

- Sample prep area location
- Arrangement of instrumentation
- Flow of analytical personnel
- Arrange lab paperwork areas
- Communicate to decision-maker
- Time-study based SOPs

b)(i)- [thermal expansion](#) in one portion of the glass

- adjacent portion may put too much [mechanical stress](#) on the surface and cause it to [fracture](#).
- slowed using an insulating material,

(ii)-spring, beam, top pan, equal-arm, unequal arm.

c) (i) main types of barometers – Mercury Barometers,

- digital friendly Aneroid Barometer

(ii) small capacities, distillers are limited to point-of-use systems.

- Distillers without gas vents, fractional columns or ACF units will not remove VOCs.
- Heat generated by a distiller must be dissipated into the surrounding environment.

d) (i) -Low concentration is nonhazardous and can go down the drain:

- Formalin solutions containing less than 2.9% formaldehyde
- Dilution of higher concentrations is not allowed to go into the drain.

(ii) -unless its concentration is less than 8% can go down the drain

- Dilution of higher concentrations is not allowed into the drain

e) (i) To work efficiently, a fume hood should be located more than 10 feet from any doorway or window and should not be located near major traffic areas.

(ii) Flooring include wood flooring, ceramic tile, stone, terrazzo, and various seamless chemical floor coatings

f) The distillation process removes almost all impurities from water. Distillers are commonly used for removing nitrate, bacteria, sodium, hardness, dissolved solids, most organic compounds, heavy metals, and radionuclides from water.

g) (i) factors such as cost, endurance, noise insulation, comfort and cleaning effort

(ii) disadvantage of Canada balsam is, that the specimen must be placed into xylene (toxic!) before embedding.

Wet specimens must first be dehydrated in alcohol and then transferred to xylene.

Transferring specimens directly from alcohol to Canada balsam won't work, because the alcohol won't dissolve the Canada balsam.

h) -Differential medium distinguish microorganisms from one another based on growth characteristics evident when grown on specific medium types.

- Organisms with differing growth characteristics typically show visible differences in growth when placed on differential media

Question TWO

(a i. Segregate incompatible chemicals (e.g., store oxidizing acids and flammable solvents in separate locations)

ii. Store hazardous materials away from heat and direct sunlight. Heat and sunlight may affect and degrade chemicals and deteriorate storage containers and labels.

iii. Do not store hazardous materials (except cleaners) under the sinks.

- iv. Ensure caps and lids are securely tightened on containers. This prevents leaks and evaporation of contents
- v. Use approved flammable storage lockers or flammable storage containers to store flammable and combustible liquids exceeding 10 gallons in one room.
- vi. Flammable and combustible liquids kept in squeeze bottles and other secondary containers may be kept on counter and bench tops provided they do not exceed the 10-gallon limit and are kept in secondary containment.
- vii. Store inorganic acids in corrosive or acid storage cabinets. Their interiors and hardware (door hinges and shelf brackets) are corrosion resistant. Corrosive storage cabinets can be located under fume hoods or exist as stand-alone units. Flammable storage cabinets are not corrosion resistant and shall not be used for inorganic acid storage.
- viii. Install Plexiglas lips or use equivalent means to prevent materials from falling off open storage shelves.

(b)-The equal-arm, or beam, balance, is an application of a [lever](#). A uniform bar, the beam, is suspended at its exact center on a knife-edge set at right angles to it.

-The point of support is called the fulcrum.

-Two pans of equal weight are suspended from the beam, one at each end, at points equidistant from the fulcrum.

-Since the center of gravity of a uniform bar is at its midpoint, the beam supporting the pans will be in equilibrium, i.e., will balance on the knife-edge.

-A long pointer attached at right angles to the beam at the fulcrum indicates zero on a scale when the beam is at rest parallel to a level surface.

-It shows also the extent of swing of the beam on one side or the other, acting somewhat as a pendulum, when the beam is coming to rest.

-The object to be weighed is placed on one pan, and standard weights are added to the other until the balance of the beam is established again.

-The unknown weight can then be determined by adding up the standard weights in the pan.

Question THREE

(a) In order to produce deionized water, cation resin is regenerated with Hydrochloric Acid (HCl).

-The Hydrogen (H⁺) is positively charged and therefore attaches itself to the negatively charged cation resin bead.

-The anion resin is regenerated with sodium hydroxide (NaOH). Hydroxyl (OH⁻) is negatively charged and attaches itself to the positively charged anion resin bead.

-Different ions are attracted to a resin bead with different strengths. For example, calcium is more strongly attracted to a cation resin bead than sodium is.

-The hydrogen on the cation resin bead and the hydroxyl on the anion resin bead do not have a strong attraction to the bead.

- As positively charged cations flow across cation resin beads, the cations are exchanged for hydrogen (H⁺).

-Likewise, as negatively charged anions flow across anion resin beads, the anions are exchanged for hydroxyl (OH⁻). When you combine hydrogen (H⁺) and hydroxyl (OH⁻) you form pure H₂O

(b) Eosin Methylene Blue agar (EMB agar) contains the dyes eosin and methylene blue.

-They inhibit Gram-positive organisms. Such a medium is selective for Gram-negative species.

-Lactose-fermenting organisms such as *E. coli* produce a black precipitate on EMB.

-Their colonies will be either black or possess dark centers with transparent, colorless peripheries.

-Non-lactose fermenters such as *Proteus sp.*, *Salmonella sp.*, or *Shigella sp.* appear pink or uncolored.

-Thus, the medium is considered differential with respect to lactose fermentation.

Question FOUR

(a) Is the waste corrosive?

Check the pH: Is it a liquid with pH less than or equal to 2, or greater than or equal to 12.5?

-Is it a solid with pH less than or equal to 2, or greater than or equal to 12.5

when mixed with an equal weight of water?

Will it aggressively corrode steel?

Will it destroy living tissue?

(b) Handling of glycerol mounting medium,

-The bottle with the solid glycerol jelly must first be warmed in a water bath to make it liquid.

-Do not make it too hot, otherwise it will not solidify any more.

-The specimen is submerged in the warm jelly and the cover glass is placed on top.

-Bubbles are a problem with this medium.

-The edges of the cover glass now must be sealed with nail polish to prevent drying out.

Question FIVE

(a) The only substances allowed down drains are those that meet all of the following criteria:

Nonhazardous:

-No radioactive waste

-No hazardous chemical waste

-No untreated biohazardous waste

Liquid:

-No solids, sludges, or viscous substances

Will not interfere with sewage treatment operations:

-No corrosive pH levels

-No grease or oil

-No hot (150°F or higher) temperatures in volumes of more than 10 gallons

(b) -Galvanometer is the historical name given to a moving coil electric current detector.

- When a current is passed through a coil in a magnetic field,

-the coil experiences a torque proportional to the current.

-If the coil's movement is opposed by a coil spring, then the amount of deflection of a needle attached to the coil may be proportional to the current passing through the coil.

- Such "meter movements" were at the heart of the moving coil meters such as voltmeters and ammeters until they were largely replaced with solid state meters.

ACH 2108 Laboratory Practice- I**Prerequisites:**

None

Purpose:

This course unit is intended to provide the student with knowledge and skills needed to work in a scientific laboratory. The course unit emphasizes on the aspects of laboratory design, installations, inspection and maintenance of laboratory facilities, laboratory wares, preparation and storage of reagents.

Objectives:

By the end of this course unit the trainees should be able to:

Describe the design of chemical laboratories.

Perform general laboratory activities.

Care for laboratory equipments and apparatus.

COURSE DESCRIPTION

Laboratory design: Laboratory Benches, Sink and drainage, Source of bench service, Floor surface, Types of Ventilation, Lighting in a Laboratory, Conversion of Existing Building of a Laboratory, Laboratory Layout. Laboratory ware: Classification, Properties and use of laboratory ware, Cleaning laboratory ware; Glassware and plastic, Platinum and Ceramic ware. Storage; labeling, position and make of storage. Effect of Reagents. Installation of laboratory equipment: Vibration; effects and remedies. Balances. Mercury barometer. Galvanometer. Glassblowing Equipments. Heavy equipment. Laboratory distillers and deionisers. Spectrographic equipments. Preparation and storage of reagents: Requirements of Preparation Room, Strength and concentration units of Solution, Chemical Reagents; grades and types. Biological Reagents; Fixatives, Stains, Mounting media, Agar media, Specified reagent. Storage of Chemicals.

Teaching Methodology:

Demonstrations, class and public lectures and tutorials.

Instructional Materials/Equipment:

Chalkboard, charts, slide and overhead/LCD projector, handouts and computers.