JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF SPATIAL PLANNING

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN WATER RESOURCE AND ENVIRONMENTAL MANAGEMENT

SEMESTER 2022/2023 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: PPB1305

COURSE TITLE: WATER END ENVIRONMENTAL QUALITY ANALYSIS

EXAM VENUE: **STREAM: SPATIAL PLANNING**

DATE: **EXAM SESSION:**

TIME: 2 HOURS

Instructions:

1. **Answer question 1 (compulsory) and ANY other 2 questions.**
2. **Candidates are advised not to write on the question paper.**
   1. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A (30 MARKS)

A1. Which of the following is NOT a reason for applying measurements of noise level in a workplace?

a) Level of exposure
b) Hearing conservation
c) Noise level control
d) Party music

A2. Which of the following are indicators of potentially hazardous noise level?

a) Use of loud speakers in a conference room
b) Listening to television set
c) People have to raise their voice to talk to someone at one metre (3 feet) away.
d) Stress brought by traffic jam

A3. The difference between the total solids and the total dissolved solids is the total suspended solids.

a) True
b) False

A4. Which of the following types of noise should be measured using a Dosimeter?

a) Personal noise exposure
b) Noise levels generated by a particular source
c) Noise survey
d) Impulse noise

A9. Which of the following statements about acidity of water is not correct?

a) Acidity of water is its quantitative capacity to neutralise a strong base to a very low pH.
b) In the sample, containing only carbon dioxide-bicarbonate carbonate, titration to pH 8.3 at 25°C corresponds to stoichiometric neutralisation of carbonic acid to carbonate.
c) Since the colour change of phenolphthalein indicator is close to pH 8.3, this value is accepted as a standard end point for the titration of total acidity.
d) For standard determination of acidity of wastewater and natural water, methyl orange acidity (pH 3.7) and phenolphthalein acidity (pH 8.3) are used.

A6. Effects of noise on humans and wildlife does not include the following?

a) Physical damage to the eardrum and the sensitive hair cells of the inner ear
b) Temporary or permanent hearing loss, known as noise-induced hearing loss
c) Cause loss of appetite
d) Raise blood pressure and pulse rates

A7. Which of the following steps is the last one leading to coagulation in water treatment?

a) Formation of a variety of soluble species such as $Al(OH)^{2+}$ and $Al(OH)^{2+}$
b) Trivalent salts hydrate to form aquometal complexes $Al(H_2O)_6^{3+}$ and $Fe(H_2O)_6^{3+}$.
c) These complexes then pass through a series of hydrolytic reactions in which H_2O molecules in the hydration shell are replaced by OH^- ions

d) When a salt of Al(III) and Fe(III) is added to water, it dissociates to yield trivalent ions

A8. Which of the following steps leads to formation of large flocs in a Jar Test?

a) Adjusting the pH of the jars coagulant dosages can be to determine optimum operating conditions.
b) Adding the coagulant to each container and stir at approximately 100 rpm for 1 minute.
c) Turning off the mixers and allowing the containers to settle for 30 to 45 minutes
d) Reduction the stirring speed to 25 to 35 rpm and continuous mixing for 15-20 minutes

A9. Which one of the following is NOT an objective of a noise survey?

a) Identifying areas where employees are likely to be exposed to harmful levels of noise
b) Locating/identifying machines and equipment which generate harmful levels of noise.
c) Relocating a factory from one site to another
d) Profiling the employees who might be exposed to unacceptable noise levels.

A10. Which of the following statements about pH relate directly to the distribution of living organisms in nature?

a) The largest variety of aquatic animals prefer a pH range of 6.5 - 8.0.
b) Physiological systems of most organisms are pH dependent.
c) Low pH can allow toxic elements and compounds such as heavy metals to become mobile and "available" for uptake by aquatic plants and animals.
d) Technically, the pH scale measures the logarithmic concentration of hydrogen (H^+) and hydroxide (OH^-) ions, which make up water ($H^+ + OH^- = H_20$).

A11. Which of these statements about the amount of chlorine in water is true?

a) If water containing chlorides is titrated with silver nitrate solution, chlorides are precipitated as white silver chloride.
b) Potassium chromate is used as indicator, which supplies chromate ions.
c) As the concentration of chloride ions approaches extinction, silver ion concentration increases to a level at which reddish brown precipitate of silver chromate is formed indicating the end point.
d) Free chlorine can never be removed from treated portable water

A12. Which of the following chemical compounds does not take part in any chemical reaction during the determination of dissolved oxygen in water?

a) Standard potassium dichromate solution
b) Sulfuric acid reagent
c) Ferroin indicator solution
d) Standard ferrous ammonium sulphate (FAS) titrant.

A13. Which of the following statements best described the limitation of TOC in measuring organic carbon in water?

a) The presence of all organic carbon may not not respond to either the BOD or COD
b) Total Organic Carbon (TOC) is a more convenient and direct expression of total organic content than either BOD or COD, but does not provide the same kind of information

c) If a repeatable empirical relationship is established between TOC and BOD or COD, then TOC can be used to estimate the accompanying BOD or COD.
d) TOC is independent of the Oxidation state of the organic matter and does not measure other organically bound elements

A14. Which of the following suspended solids in water represents the organic components?
a) Total suspended solids
b) Total dissolved solids
c) Fixed solids
d) Volatile solids

A15. Which of the following is NOT considered when planning noise measurement?
a) The purpose of measurement: compliance with noise regulations, hearing loss prevention, noise control, community annoyance etc.
b) The sources of noise, and times when the sources are operating.
c) Conditions during both a typical and atypical shift (noise sources, activities, shift length, etc.)
d) Surface area of the work place

A16. Which of the following description of *Escherichia coli* for the purpose of sanitary examination of water does not fit its characteristics?
a) Gram-negative, non-spore forming rod which is capable of fermenting lactose with the production of acid and gas at 35°C in less than 48 hours
b) Produces indole peptone water containing tryptophan, which is incapable of utilising sodium citrate as its sole source of carbon
c) Is not a zoonotic microorganism
d) Is incapable of producing acetyl methyl carbinol, and

A17. Does the gram -ve bacteria initially stains violet and turns purple after counter-staining?
a) True
b) False

A18. The number of positive findings of coliform group organisms resulting from the multiple dilutions should be computed as the combination of positives and recorded in terms of the Most Probable Number (MPN)
a) True
b) False

A19. Which of the following does not reflect removal of interference by compounds and ions during the determination of nitrates in water?
a) Addition of brucine-sulphanilic acid reagent
b) Addition of Sodium arsenite
c) Addition of excess NaCl
d) Boiling in water bath

A20. Which of the conditions listed apply for the determination of Ammonia Nitrogen in water?
a) Colorimetric method is applicable

b) Nessler's reagent is used
c) Is sensitive to 20mg/L of ammonia N and may be used up to 5mg/L of ammonia N.
d) Analysed can be done several days after collection without preservation

A21. Which of the following is the first step in the determination of Ammonia Nitrogen by Nesslerization?

a) Reaction with NH_3 in alkaline solution to form a yellowish-brown colloidal dispersion
b) Adding of Nesslers reagent, which is a strong alkaline solution of potassium mercuric iodide (K_2HgI_4).
c) Pre-treatment using zinc sulphate and sodium hydroxide
d) Measured in a spectrophotometer in the wavelength of 400-500 μm with a light path of 1cm.

A22. Which of the following sources of soil pollution is a natural process?

a) Toxic substances occurring in soil, such as arsenic, a heavy metal.
b) Residues from pesticides and herbicides build up in the soil of farmlands
c) Spilling on the ground, hazardous substances, such as solvents, may soak into soil
d) Underground tanks leak

A23. Which one of the following impacts of soil pollution can be mitigated by legislation?

a) Undesirable change in the physical, chemical and biological characteristics of soil
b) Affect human life, lives of other useful living plants and animals,
c) Adversely interfere with health, comfort, property or environment of the people
d) Industrial progress
e) Living conditions and cultural assets.

A24. Which of the following effects of deforestation is considered to impact on ecosystem services related to land pollution?

a) Pressure of population growth and development (especially timber, construction and agriculture)
b) Extraction of a wealth of medicinal substances
c) Destruction of the most productive flora and fauna areas in the world
d) Loss of vast tracts of a very valuable sink for CO_2

A25. Which one of the following is likely to be caused directly by industrial pollution?

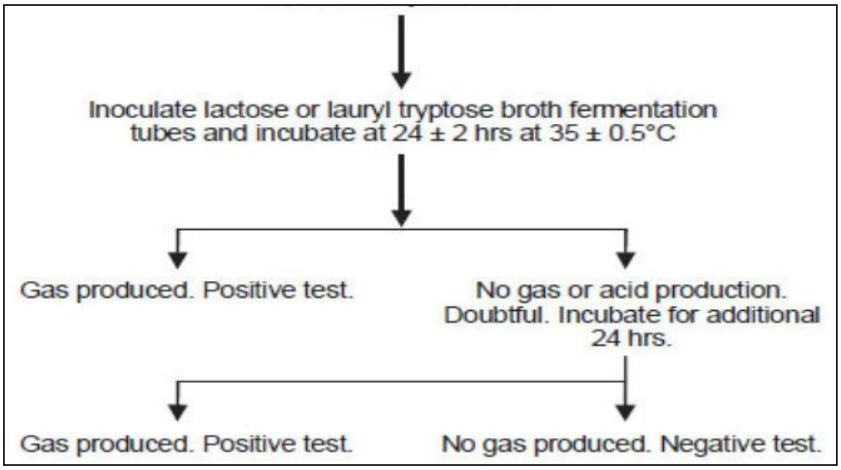
a) Ecological imbalance
b) Reduced soil fertility
c) Dangerous chemicals entering water systems
d) Reduced crop yield

A26. Which of the following analytical tool is suitable the Chemistry component of the Level of Evidence of the TRIAD of site-specific assessment of contaminated soils?

a) Bioassays (in field and/or in lab), biomarkers etc.
b) Field observations of vegetation, soil fauna, micro-organisms, etc
c) Measurement of total concentrations, bio-available concentrations& bioaccumulation,
d) Visual examination of the affected area

A27. State whether the schematic diagram for coliform bacteria in water presented below represent:

a) Presumptive test
b) Confirmed test
c) Completed test



A28. Which of the following steps is the first to be considered in developing remedial objectives to mitigate soil pollution?

a) The *exposure assessment* describes the pathways by which soil contaminants may be taken up by the receptor.
b) *Problem formulation* involves developing a conceptual model of the possible contaminant effects on receptors at the site.
c) The *toxicity assessment* describes the adverse effects that the contaminants may cause and the dose at which these effects occur.
d) *Legal action* against the proponents of the activity being assessed for risks

A29. Which of the following is an odd-one-out in surveying for assessment of the impact of pollution on the soil invertebrate community?

a) Collection of soil samples followed by extraction in the laboratory.
b) Extraction or collection of organisms in the field, e.g. by hand-sorting or by the application of mustard or formalin.
c) Trapping (surface dwelling) animals by the use of e.g. pit-falls.
d) Biological Indicator for Soil Quality (BISQ)

A30. Which of the following general considerations to be made in the planning phase of a successful field survey for soil pollution is not entirely correct?

a) Identification of the targets of concern and the species to monitor.
b) Elucidation of the natural temporal and spatial variation before initiating a field study.
c) Use of statistical (power) analyses to determine the minimum number of samples or replicates needed to demonstrate the decided difference, e.g. 25% change.
d) The number of confounding parameters to determine cause-effect at the affected site only

SECTION B (20 MARKS)

B1. Outline the possible method of reducing noise pollution from motorways close to residential areas (5 Marks)

B2. Explain some of the engineering design considerations used to reduce noise pollution in habitable environments (5 Marks)

B3. Outline the components of carbonate, bicarbonate and total alkalinity (5 Marks)

B4. Describe briefly the relationship between soap and water hardness (5 Marks)

B5. Explain how the physical properties of Formazine polymer makes it suitable for use in determining water turbidity (5 Marks)

B7. Discuss the interference with BOD measurements caused by different compounds and ions (5 Marks)

SECTION C (20 MARKS)

C1. Discuss the Water Quality Guidelines provided by the Water Services Regulatory Board (WASREB) with respect to institutional framework, (20 Marks)

C2. Discuss how and why the determination of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD) are critical for assessing the overall quality of wastewaters (20 Marks)

C3. Discuss the challenges posed by Carbonaceous and Nitrogenous compounds in the determination of Biological Oxygen Demand (BOD) (20 Marks)

C4. Discus the systematic approach to Ecological Risk Assessment (20 Marks)