THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

733/1 BIOLOGY 1

Time: 3 Hours **ANSWERS** **Year: 2020**

Instructions

1. This paper consists of section A, B and C.
2. Answer all questions in section A and two questions from section B and C.

1. What four features categorize mosses and liverworts in the same group?

Mosses and liverworts are categorized together due to their lack of vascular tissues, such as xylem and phloem, relying on diffusion for water and nutrient transport.

They reproduce via spores rather than seeds, using structures like sporophytes for dispersal, a common reproductive strategy.

Both are non-vascular plants, typically growing in moist environments, which supports their simple structure and water absorption.

They exhibit a gametophyte-dominant life cycle, where the gametophyte generation is the most prominent phase, distinguishing them from vascular plants.

2. How does aerobic differ from anaerobic respiration? Give four points.

Aerobic respiration requires oxygen as the final electron acceptor, producing more ATP (up to 38 molecules per glucose) compared to anaerobic respiration, which yields only 2 ATP.

It occurs in the mitochondria, utilizing the Krebs cycle and electron transport chain, while anaerobic respiration happens in the cytoplasm, relying on fermentation or other pathways.

Aerobic respiration fully oxidizes glucose to carbon dioxide and water, releasing significant energy, whereas anaerobic respiration produces byproducts like lactic acid or ethanol with less energy release.

It is more efficient for sustained energy needs, supporting activities like long-distance running, while anaerobic respiration is suited for short bursts, such as sprinting.

3. With examples, give four disadvantages of modern methods of birth control.

Modern methods like oral contraceptives can cause hormonal side effects, such as nausea or mood swings, impacting user health and comfort.

Intrauterine devices (IUDs) may lead to infections or uterine perforation in rare cases, posing risks that require medical attention.

Condoms, if improperly used, can fail, leading to unintended pregnancies, reducing reliability during critical moments.

Hormonal implants may cause irregular bleeding or weight gain, potentially discouraging long-term use among some individuals.

4. (a) sex determination and sex linkage.

(b) co — dominance and incomplete dominance.

(a) sex determination and sex linkage:

Sex determination is the biological process that decides an organism's sex, often governed by sex chromosomes (e.g., XX for female, XY for male in humans). Sex linkage refers to the inheritance of traits carried on sex chromosomes, such as hemophilia on the X chromosome, affecting males more due to their single X.

(b) co — dominance and incomplete dominance:

Co-dominance occurs when both alleles in a heterozygote are fully expressed, like the AB blood type where A and B antigens coexist. Incomplete dominance is when the heterozygous phenotype is a blend of the two alleles, such as red and white flowers producing pink offspring in snapdragons.

5. Give four situations where safe precaution measures should be observed by both students and teachers during teaching and learning of biology.

Handling sharp tools, like scalpels during dissection, requires gloves and careful handling to prevent cuts, protecting both students and teachers.

Working with preservatives, such as formaldehyde, necessitates ventilation and masks to avoid inhalation hazards in the lab.

Using microscopes with electrical components demands ensuring dry hands and stable setups to prevent shocks or equipment damage.

Conducting experiments with live organisms, like frogs, requires hygiene practices and containment to avoid allergic reactions or escapes.

6. How does teacher's guide assist the teaching and learning process? Give four points.

A teacher's guide provides structured lesson plans, outlining topics like photosynthesis, helping teachers organize content effectively.

It offers teaching strategies, such as group activities for cell structure, enhancing student engagement and understanding.

The guide includes assessment tools, like quizzes on genetics, enabling teachers to evaluate student progress accurately.

It supplies resource suggestions, such as diagrams or videos, enriching the learning experience with visual aids.

7. Classify enzymes into four groups according to the type of reaction they catalyze.

Oxidoreductases catalyze oxidation-reduction reactions, such as dehydrogenases converting NADH to NAD^+.

Transferases facilitate the transfer of functional groups, like kinases transferring phosphate in ATP synthesis.

Hydrolases break bonds using water, such as amylase hydrolyzing starch into sugars.

Lyases catalyze the addition or removal of groups without hydrolysis, like decarboxylases removing CO_2 from substrates.

8. In what ways do air, water and land pollution a threat to aquatic life? Give four points.

Air pollution, like acid rain from sulfur dioxide, lowers water pH, harming fish and aquatic plants sensitive to acidic conditions.

Water pollution from oil spills coats fish gills, reducing oxygen intake and causing suffocation or death.

Land pollution, through pesticide runoff, introduces toxins into water bodies, disrupting aquatic food chains and killing organisms.

Thermal pollution from industrial discharge raises water temperatures, reducing dissolved oxygen levels, stressing or killing aquatic species.

9. Construct one multiple choice item on plant and animal cells and use it to illustrate the following concepts:

(a) Stem

(b) Distractor

(c) Alternatives

(a) Stem:

What structure is found in plant cells but not in animal cells?

A) Cell wall

B) Mitochondria

C) Nucleus

D) Cytoplasm

(b) Distractor:

The distractors are B) Mitochondria, C) Nucleus, and D) Cytoplasm, which are incorrect options designed to challenge students by including common cell components.

(c) Alternatives:

The alternatives are A) Cell wall (correct), B) Mitochondria, C) Nucleus, and D) Cytoplasm, providing multiple choices to test knowledge of cell structure differences.

10. Why is it emphasized to use participatory methods in teaching and learning biology?

Participatory methods enhance student engagement, as hands-on activities like dissections make learning about organs interactive and memorable.

They foster critical thinking, encouraging students to hypothesize and analyze data during experiments on photosynthesis.

These methods promote teamwork, as group projects on ecosystems develop collaboration skills among learners.

They improve retention, as active participation in field studies of plant adaptations reinforces theoretical knowledge.

11. In what ways do seed bearing plants adapted to life on land? Give six points.

Seed bearing plants have developed roots to anchor in soil and absorb water, supporting growth on land.

They possess a waxy cuticle on leaves to reduce water loss, adapting to dry terrestrial environments.

Stomata with guard cells regulate gas exchange and water loss, optimizing photosynthesis on land.

Vascular tissues, like xylem and phloem, transport water and nutrients, enabling tall growth above ground.

Seeds protect embryos and provide nutrients, ensuring survival during unfavorable conditions on land.

Pollen allows wind or insect-mediated reproduction, reducing reliance on water for fertilization.

12. Evaluate the usefulness of protein in human body. Give six points.

Proteins serve as enzymes, like amylase, catalyzing metabolic reactions to maintain bodily functions.

They form structural components, such as collagen in skin, providing strength and support to tissues.

Proteins act as antibodies, like immunoglobulins, defending against infections and boosting immunity.

They function as hormones, such as insulin, regulating processes like blood sugar levels.

Proteins aid in muscle repair and growth, supporting physical activity and development.

They transport molecules, like hemoglobin carrying oxygen, ensuring efficient nutrient delivery.

13. You are required to teach Form Three students about the Krebs cycle. Use the following guiding questions to enable students understand the topic:

(a) State two raw materials for the Krebs cycle.

(b) Draw the cycle to show eight major steps involved in energy production.

(c) Name the steps in which reduced NAD are used to produce ATP.

(d) How many molecules of ATP will be produced in the absence of oxygen?

(a) State two raw materials for the Krebs cycle:

The Krebs cycle uses acetyl-CoA, derived from pyruvate, and oxaloacetate as raw materials to initiate the cycle and produce energy.

(b) Draw the cycle to show eight major steps involved in energy production:

(Description since drawing isn't possible: Start with acetyl-CoA combining with oxaloacetate to form citrate, followed by isomerization to isocitrate, decarboxylation to α-ketoglutarate, another decarboxylation to succinyl-CoA, conversion to succinate, then fumarate, malate, and back to oxaloacetate, releasing CO_2, NADH, $FADH_2$, and GTP at specific steps.)

(c) Name the steps in which reduced NAD are used to produce ATP:

Reduced NAD (NADH) is produced in the isocitrate to α-ketoglutarate step, α-ketoglutarate to succinyl-CoA step, and malate to oxaloacetate step, and is later used in the electron transport chain to generate ATP.

(d) How many molecules of ATP will be produced in the absence of oxygen?

In the absence of oxygen, the Krebs cycle stops after producing NADH and $FADH_2$, but without the electron transport chain, only 2 ATP molecules are generated directly from GTP in the succinyl-CoA to succinate step.

14. (a) What will happen if one teaches without a syllabus? Give six points.

(b) Analyse three strengths of using the centralized syllabus in teaching and learning of biology subject.

(a) What will happen if one teaches without a syllabus? Give six points:

Teaching without a syllabus leads to a lack of direction, as there's no clear outline of topics like cell biology, causing disorganized lessons.

It results in uneven coverage, with some areas, such as genetics, being overemphasized while others, like ecology, are neglected.

Students may miss critical concepts, such as photosynthesis, due to the absence of a structured progression, hindering comprehensive learning.

Assessment becomes challenging, as there's no basis for designing tests aligned with learning goals, reducing fairness.

Teachers may duplicate efforts, revisiting topics like enzymes without a plan, wasting time and resources.

Lastly, it affects coordination with other educators, as there's no common framework, leading to inconsistencies in student preparation.

(b) Analyse three strengths of using the centralized syllabus in teaching and learning of biology subject:

A centralized syllabus ensures uniformity, providing all teachers with the same topics, like evolution, ensuring consistent education across schools.

It facilitates resource development, as materials like textbooks on cell structure are designed to match the syllabus, supporting effective teaching.

It simplifies assessment standardization, allowing national exams on topics like respiration to be fair and comparable, enhancing educational equity.

15. Creating learning environment that promotes cooperative learning is among the principles of teaching and learning biology. As a specialist teacher, why should this principle be adhered during teaching and learning process? Give five reasons.

Creating a learning environment that promotes cooperative learning enhances student engagement, as group activities like dissecting a frog encourage participation and make biology interactive.

It fosters peer support, allowing students to explain concepts like photosynthesis to each other, improving understanding through collaboration.

Cooperative learning develops communication skills, as students discuss topics like genetics in groups, preparing them for real-world interactions.

It builds teamwork, essential for lab experiments on enzyme action, teaching students to work effectively with others.

Lastly, it increases retention, as shared problem-solving on ecological balance reinforces knowledge through active discussion and practice.

16. (a) Explain the following terms as used in assessment:

(i) Standard deviation of scores

(ii) Test item analysis

(iii) Difficulty index of a test item

(iv) Discrimination index

(b) A Form One student scored 80% in a midterm Biology test. If the standard deviation was 4 and the average mark was 60%, calculate:

(i) Z - score.

(ii) T - score.

(a) (i) Standard deviation of scores:

Standard deviation of scores measures the spread of test results around the mean, indicating variability; a higher value, like 10, shows greater diversity in student performance on a biology test.

(ii) Test item analysis:

Test item analysis evaluates the effectiveness of individual questions, assessing if items on topics like cell structure discriminate well between high and low performers.

(iii) Difficulty index of a test item:

Difficulty index of a test item is the proportion of students who answer a question correctly, such as 70% passing a question on respiration, indicating its challenge level.

(iv) Discrimination index:

Discrimination index measures how well a test item distinguishes between high and low achievers, with a positive value for a genetics question showing it favors top students.

(b) (i) Z - score:

Z-score = (student score - mean) / standard deviation = (80 - 60) / 4 = 20 / 4 = 5, indicating the student's score is 5 standard deviations above the mean.

(ii) T - score:

T-score = (Z-score × 10) + 50 = (5 × 10) + 50 = 100, converting the z-score to a scale with a mean of 50 and standard deviation of 10, showing exceptional performance.