

TFS High School

COURSE OUTLINE

| | |
|--|---|
| COURSE TITLE | Biology 12 |
| COURSE CODE | SBI4U |
| GRADE | 12 |
| COURSE TYPE | University Preparation |
| CREDIT VALUE | 1.00 |
| COURSE HOURS | 110 Hours |
| DEPARTMENT | Science |
| COURSE DEVELOPER(S) | Abbas Hemmati |
| DEVELOPMENT DATE | 2014 |
| REVISION DATE | 2023 |
| MINISTRY CURRICULUM POLICY DOCUMENT | <i>Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, First edition: 2010 Science, The Ontario Curriculum, Grade 11 and 12, 2008, Revised</i> |
| PREREQUISITE | SBI3U |
| TEACHER | Abbas Hemmati |

Course Description

This course provides students with the opportunity for in-depth study of the concepts and processes associated with biological systems. Students will study theory and conduct investigations in the areas of biochemistry, metabolic processes, molecular genetics, homeostasis, and population dynamics. Emphasis will be placed on achievement of the detailed knowledge and

refinement of skills needed for further study in various branches of the life sciences and related fields

OVERALL CURRICULUM EXPECTATIONS

A. SCIENTIFIC INVESTIGATION SKILLS AND CAREER EXPLORATION

Overall Expectations

Throughout this course, students will:

1. . demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);
2. . identify and describe careers related to the fields of science under study, and describe contributions of scientists, including Canadians, to those fields.

B. BIOCHEMISTRY

Overall Expectations

By the end of this course, students will:

1. analyse technological applications of enzymes in some industrial processes, and evaluate technological advances in the field of cellular biology;
2. investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions;
3. demonstrate an understanding of the structures and functions of biological molecules, and the biochemical reactions required to maintain normal cellular function.

C. METABOLIC PROCESSES

Overall Expectations

By the end of this course, students will:

1. analyse the role of metabolic processes in the functioning of biotic and abiotic systems, and evaluate the importance of an understanding of these processes and related technologies to personal choices made in everyday life;
2. investigate the products of metabolic processes such as cellular respiration and photosynthesis;
3. demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes.

D. MOLECULAR GENETICS

Overall Expectations

By the end of this course, students will:

1. analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology;
2. investigate, through laboratory activities, the structures of cell components and their roles in processes that occur within the cell;
3. demonstrate an understanding of concepts related to molecular genetics, and how genetic modification is applied in industry and agriculture.

E. HOMEOSTASIS

Overall Expectations

By the end of this course, students will:

1. evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity;
2. investigate the feedback mechanisms that maintain homeostasis in living organisms;
3. demonstrate an understanding of the anatomy and physiology of human body systems, and explain the mechanisms that enable the body to maintain homeostasis.

F. POPULATION DYNAMICS

Overall Expectations

By the end of this course, students will:

1. analyse the relationships between population growth, personal consumption, technological development, and our ecological footprint, and assess the effectiveness of some Canadian initiatives intended to assist expanding populations;
2. investigate the characteristics of population growth, and use models to calculate the growth of populations within an ecosystem;
3. demonstrate an understanding of concepts related to population growth, and explain the factors that affect the growth of various populations of species.

UNIT, DESCRIPTION AND TIME

| Unit | Titles and Descriptions | Time Frame |
|------|--|------------|
| 1 | <p>Biochemistry:</p> <p>Review of Bonding: Intramolecular and Intermolecular Properties of water Functional groups Acids, Bases and Buffers Carbohydrates, Lipids, Proteins and Nucleic Acids Enzymes: induced fit and Lock and Key theories; factors affecting enzyme activity, co-factors, co-enzymes, applications of enzyme activity in the food and pharmaceutical industries Allosteric inhibition, competitive inhibition and feedback inhibition Biological reactions: dehydration synthesis, hydrolysis, neutralization, redox reactions, anabolic and catabolic reactions Cellular organelles Structure of cell membrane: Fluid mosaic model Passive transport: diffusion and osmosis Active transport: Exocytosis, endocytosis, receptor mediated endocytosis</p> | 26 hrs. |
| 2 | <p>Metabolic Processes:</p> <p>Laws of thermodynamics Oxidative phosphorylation and substrate-level phosphorylation Stages of cellular respiration: glycolysis, pyruvate oxidation, Krebs' Cycle and electron transport chain Anaerobic respiration: Lactic acid fermentation and ethanol fermentation Alternate pathways: lipid and protein catabolism VO₂ max Light and accessory pigments Structure of leaf Guard cells and control of stomata Visible light, absorption spectrum and action spectrum</p> | 20 hrs. |

| | | |
|----------|---|------------------|
| | Chlorophyll Photosystems and photophosphorylation Light dependent reactions: cyclic and non-cyclic electron flow Light-independent reactions Chromatography | |
| 3 | Molecular Genetics: History of discovery of structure of DNA DNA Experiments: Hershey and Chase, Oswald and Avery DNA replication Structure of RNA <i>Protein Synthesis</i> Protein Synthesis: Central Dogma, Transcription, Translation, Post-transcriptional modifications Control of gene expression: lac and trap Operons Mutations: point mutations, frameshift mutations BLAST: Basic Local Alignment Search Tool Chromosomal structure <i>Biotechnology</i> Restriction enzymes Gel electrophoresis and practical applications Recombinant DNA technology Social, ethical and legal implications | 26 hrs. |
| 4 | Homeostasis: Negative and positive feedback loops Thermoregulation Urinary system Osmoregulation <i>Chemical Signals Maintain Homeostasis</i> Endocrine system Hormones Factors affecting blood sugar Metabolism Adjustments to Stress <i>How Nerve Signals Maintain Homeostasis</i> Central nervous system Brain: parts and function Neurons Reflexes and reflex arc Electrochemical impulse Synaptic transmission Autonomic nervous system Sympathetic vs. parasympathetic nervous system | 26 hrs. |
| 5 | Population Dynamics: <i>Population Ecology</i> Population density; patterns of dispersion Random sampling techniques: quadrat and mark-recapture Types of interaction between species Population growth models: geometric, exponential, logistic Carrying capacity | 10 hrs. |
| 6 | Final Evaluation | 2 |
| | Total | 110 hours |

STRATEGIES FOR ASSESSMENT AND EVALUATION OF STUDENT PERFORMANCE:

| Assessment as Learning | Assessment for Learning | Assessment of Learning |
|---|---|--|
| Student Product -Learning Logs (anecdotal) Quizzes (scale/rubric) | Student Product Assignment Quizzes (scale/rubric) Reports(rubric) Entrance Ticket/Exit Card | Student Product Assignment(s) Tests(scale/rubric) Exam (marking scheme) Research Reports(rubric) Lab report |
| Observation Peer feedback Daily website work Goal setting/Revising | Observation Whiteboard work Class Discussions (anecdotal) PowerPoint presentations (rubric) | Observation PowerPoint presentation (rubric) Lab report investigation process(checklist) |
| Conversation Small Group Discussions (checklist) Pair work (checklist) Conferencing | Conversation Small Group Discussions (checklist) Pair work (checklist) Peer feedback (anecdotal) Oral quizzes (scale/rubric) | Conversation Question and Answer Sessions(checklist) Oral tests (scale/rubric) Conversation to probe product pieces |

TEACHING AND LEARNING STRATEGIES

Along with some of the strategies noted in the assessment for, as, and of learning charts below, strategies will include (but not limited to):

- Lecture
- Discussion
- Problem posing
- demonstration
- Mathematical problem solving
- Homework
- Assignment
- Investigative Inquiry
- Lab report

ASSESSMENT STRATEGIES

| | | | |
|-------------------|------------------|--------------|-------------------------|
| Quiz | Report | Presentation | Extended Investigations |
| Test (diagnostic) | Skills Checklist | Interview | Project |

THE FINAL GRADE

| Percentage of Final Mark | Weight | Evaluation Categories | Assessment will be ongoing to inform the students of their performance and the opportunity for success. Four achievement categories are illustrated in the chart. K: Knowledge and Understanding 30% I: Inquiry/Thinking 25% C: Communication 25% MC: Making Connections/Application 20% |
|--------------------------|--------|--------------------------------|--|
| 70% | 50% | Tests, Poster and quizzes | |
| | 20% | Lab | |
| 30% | 10% | Scientific Writing | |
| | 20% | Final Project/Culminating Task | |

REFERENCES

[1] Biology 12, by Nelson Education Ltd, 2012.

[2] The Ontario Curriculum Grade 11 and 12 Science

http://www.edu.gov.on.ca/eng/curriculum/secondary/2009science11_12.pdf

Learning Skills:

ACHIEVEMENT CHART: SCIENCE, GRADES 9-12

| Category | 50-59% (Level 1) | 60-69% (Level 2) | 70-79% (Level 3) | 80-100% (Level 4) |
|--|--|---|---|--|
| Knowledge and Understanding - Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding) | | | | |
| | The student: | | | |
| understanding of concepts, principles, laws, and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations) | demonstrates limited understanding of concepts, principles, laws, and theories | demonstrates some understanding of concepts, principles, laws, and theories | demonstrates considerable understanding of concepts, principles, laws, and theories | demonstrates thorough understanding of concepts, principles, laws, and theories |
| knowledge of facts and terms | demonstrates limited knowledge of facts and terms | demonstrates some knowledge of facts and terms | demonstrates considerable knowledge of facts and terms | demonstrates thorough knowledge of facts and terms |
| transfer of concepts to new contexts | infrequently transfers simple concepts to new contexts | sometimes transfers simple concepts to new contexts | usually transfers simple concepts to new contexts | routinely transfers simple concepts to new contexts |
| understanding of relationships between concepts | demonstrates limited understanding of relationships between concepts | demonstrates some understanding of relationships between concepts | demonstrates considerable understanding of relationships between concepts | demonstrates thorough and insightful understanding of relationships between concepts |
| Thinking and Inquiry - The use of critical and creative thinking and inquiry skills and/or processes | | | | |
| | The student: | | | |
| application of the skills and strategies of scientific inquiry (e.g., | applies few of the skills and strategies of scientific inquiry | applies some of the skills and strategies of scientific inquiry | applies most of the skills and strategies of scientific inquiry | applies all or almost all of the skills and |

| | | | | |
|---|---|---|--|---|
| initiating and planning, performing and recording, analysing and interpreting, problem solving) | | | | strategies of scientific inquiry |
| application of technical skills and procedures (e.g., microscopes) | applies technical skills and procedures with limited competence | applies technical skills and procedures with moderate competence | applies technical skills and procedures with considerable competence | applies technical skills and procedures with a high degree of competence |
| use of tools, equipment, and materials | uses tools, equipment, and materials safely and correctly only with supervision | uses tools, equipment, and materials safely and correctly with some supervision | uses tools, equipment, and materials safely and correctly | demonstrates and promotes the safe and correct use of tools, equipment, and materials |

Communication - The conveying of meaning through various forms

| | | | | |
|---|---|--|--|--|
| | The student: | | | |
| communication of information and ideas | communicates information and ideas with limited clarity and precision | communicates information and ideas with some clarity and precision | communicates information and ideas with considerable clarity and precision | communicates information and ideas with a high degree of clarity and precision |
| use of scientific terminology, symbols, conventions, and standard (SI) units | uses scientific terminology, symbols, conventions, and SI units with limited accuracy and effectiveness | uses scientific terminology, symbols, conventions, and SI units with some accuracy and effectiveness | uses scientific terminology, symbols, conventions, and SI units with considerable accuracy and effectiveness | uses scientific terminology, symbols, conventions, and SI units with a high degree of accuracy and effectiveness |
| communication for different audiences and purpose | communicates with a limited sense of audience and purpose | communicates with some sense of audience and purpose | communicates with a clear sense of audience and purpose | communicates with a strong sense of audience and purpose |
| use of various forms of communication (e.g., reports, essays) | demonstrates limited command of the various forms | demonstrates moderate command of the various forms | demonstrates considerable command of the various forms | demonstrates extensive command of the various forms |
| use of information technology for scientific purposes (e.g., specialized databases) | uses technology with limited appropriateness and effectiveness | uses technology with moderate appropriateness and effectiveness | uses appropriate technology with considerable effectiveness | uses appropriate technology with a high degree of effectiveness |

Application - The use of knowledge and skills to make connections within and between various contexts

| | | | | |
|--|---|---|--|---|
| | The student: | | | |
| understanding of connections among science, technology, society, and the environment | shows limited understanding of connections in familiar contexts | shows some understanding of connections in familiar contexts | shows considerable understanding of connections in familiar and some unfamiliar contexts | shows thorough understanding of connections in familiar and unfamiliar contexts |
| analysis of social and economic issues involving science and technology | analyses social and economic issues with limited effectiveness | analyses social and economic issues with moderate effectiveness | analyses social and economic issues with considerable effectiveness | analyses complex social and economic issues with a high degree of effectiveness |

| | | | | |
|---|---|--|--|---|
| assessment of impacts of science and technology on the environment | assesses environmental impacts with limited effectiveness | assesses environmental impacts with moderate effectiveness | assesses environmental impacts with considerable effectiveness | assesses environmental impacts with a high degree of effectiveness |
| proposing of courses of practical action in relation to science and technology-based problems | extends analyses of familiar problems into courses of practical action with limited effectiveness | extends analyses of familiar problems into courses of practical action with moderate effectiveness | extends analyses of familiar problems into courses of practical action with considerable effectiveness | extends analyses of familiar and unfamiliar problems into courses of practical action with a high degree of effectiveness |

LEARNING SKILLS

Learning Skills are skills and habits are essential to success in school and in the workplace. Teachers report achievement on the six Learning Skills in the table below using letter codes:

E = Excellent

G = Good

S = Satisfactory

N = Needs Improvement.

| Learning Skills | Sample Behaviors |
|------------------|---|
| Responsibility | The student fulfils responsibilities and commitments within the learning environment; completes and submits class work, homework, and assignments according to agreed-upon timelines; takes responsibility for and manages own behavior. |
| Organization | The student devises and follows a plan and process for completing work and tasks; establishes priorities and manages time to complete tasks and achieve goals; identifies, gathers, evaluates, and uses information, technology, and resources to complete tasks. |
| Independent Work | The student independently monitors, assesses, and revises plans to complete tasks and meet goals; uses class time appropriately to complete tasks; follows instructions with minimal supervision. |
| Collaboration | The student accepts various roles and an equitable share of work in a group; responds positively to the ideas, opinions, values, and traditions of others; builds healthy peer-to-peer relationships through personal and media-assisted interactions; works with others to resolve conflicts and build consensus to achieve group goals; shares information, resources, and expertise and promotes critical thinking to solve problems and make decisions. |
| Initiative | The student looks for and acts on new ideas and opportunities for learning; demonstrates the capacity for innovation and a willingness to take risks; demonstrates curiosity and interest in learning; approaches new tasks with a positive attitude; recognizes and advocates appropriately for the rights of self and others. |
| Self-Regulation | The student sets own individual goals and monitors progress towards achieving them; seeks clarification or assistance when needed; assesses and reflects critically on own strengths, needs, and interests; identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; perseveres and makes an effort when responding to challenges. |

ACADEMIC HONESTY: CHEATING AND PLAGIARISM:

Plagiarism is a serious offense. It is defined as taking words, phrasing, sentence structure, or any other element of the expression of another person's **ideas**, and using them as if they were your own. Plagiarism is a violation of another person's rights, whether the material taken is excessive or small. Students will be assisted in developing strategies and

techniques to avoid plagiarism. They need to be aware that plagiarized term work will be penalized and could result in a mark of zero.

Assignment Policy, Missed Tests and Attendance: Please refer to Student Contract Form

PROGRAM PLANNING CONSIDERATIONS FOR SCIENCE

Teachers planning a program in Science must take into account considerations in a number of important areas. Essential information that pertains to all disciplines is provided in the companion piece to this document, *Science. The Ontario Curriculum, Grades 11 and 12: Some Considerations for Program Planning, 2008*. The areas of concern to all teachers include the following:

The Role of Technology in the Curriculum. Using information technology will assist students in the achievement of many of the expectations in the curriculum regarding research, written work, analysis of information, and visual presentations.

English As a Second Language (ESL): Appropriate accommodations in teaching, learning, and evaluation strategies will be made to help ESL students gain proficiency in English, since students taking ESL at the secondary level have limited time in which to develop this proficiency.

Career Education: Expectations in this course include many opportunities for students to explore educational and career options, and to become self-directed learners.

Health and Safety in Science

Environmental Education

Critical Thinking and Critical Literacy in Science

Literacy, Mathematical Literacy, and Investigation (Inquiry/Research) Skills