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<td>Students</td>
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<td>Teachers</td>
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<td>Administrators</td>
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<td>Parents</td>
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<td>General Audience</td>
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<td>Others</td>
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**Time Limits on Diploma Examinations**

All students may now use extra time to write diploma exams. This means that all students now have up to 6 hours to complete the Biology 30 Diploma Examination, if they need it. **The examination is still designed so that the majority of students can comfortably complete it within 3 hours.** The examination instructions state both the original time and the total time now available.

Extra time is available for diploma examinations in all subjects, but the total time allowed is not the same in all subjects. For more information about accommodations and provisions for students, please refer to the *General Information Bulletin*.

**Course Objectives**

Biology 30 is intended to develop students’ understanding and application of biological concepts and skills. The focus of this course is on understanding the biological principles behind the natural events the students experience and the technology they use in their daily lives. Biology 30 is an experimental discipline that develops knowledge, skills, and attitudes to help students become capable of and committed to setting goals, making informed choices, and acting in ways that will improve their own lives as well as life in their communities.

Biology 30 students will develop their ability to observe, generalize, hypothesize, and infer through observation. They will show growth in their understanding of biological concepts by increasing their ability to apply these concepts to relevant situations and new contexts. Throughout the course, students will continue to develop scientific literacy, and they will learn to communicate in the specialized language of biology.

Success in Biology 30 requires the successful completion of Science 10 and Biology 20, which develop the requisite knowledge and skills.

**Program of Studies**

The revised *Biology 30 Program of Studies* was implemented in September 2008, and the first diploma examination on the revised program was administered in January 2009. The program was updated in 2014 to include links to mathematics.

The program of studies is available online at education.alberta.ca.
Alberta Education receives questions and feedback from teachers and students by email, by phone, at working-group sessions, on field tests, and on perusal copies of diploma examinations. Comments and questions are both appreciated and encouraged. In response to the questions and feedback received, the following points clarify some aspects of the Biology 30 Diploma Examination. Several clarifications have appeared in previous years, and they are compiled in the archived bulletin.

• The first two skills outcomes in each general outcome in the Biology 30 Program of Studies (e.g., A1.1s, A1.2s, B1.1s, B1.2s) are the same in every unit, and both relate to scientific inquiry:
  – “Students will formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues.”
  – “Students will conduct investigations into relationships between and among observable variables and use a broad range of tools and techniques to gather and record data and information.”

Therefore, questions related to experimental variables in the context of any unit of study in Biology 30 should not be unexpected.

• Outcome B2.1k refers to the role of hormones, including GnRH, in the regulation of primary and secondary sex characteristics; therefore, students can expect to see questions on the role of GnRH in human reproduction, including its interaction with other hormones and associated feedback mechanisms.

• Outcome C1.3k, C1.4k, and C1.5k relate to meiosis, including the idea of crossing over. Students are expected to understand that crossing over generally begins in prophase I once tetrads have been formed.

• Outcomes C2.2k, C2.5k, and C2.3s refer to inheritance patterns, genotypes, and phenotypes. Students are expected to understand the difference between a genotype and a phenotype. For example, if asked to predict a genotypic ratio, students should be looking for an alternative that includes genotypes (e.g., $I^A I^B$) rather than phenotypes (type AB blood). It is possible that both responses are present in the alternatives; students need to choose the genotype or phenotype, as appropriate, to show that they understand the difference between the two concepts.

• The Biology 30 Program of Studies requires students to analyze and interpret data, including graphical data (e.g., A2.3s, B2.2s, B2.3s, B3.3s). As much as possible, graphical data is sourced from scientific research and presented authentically. Students will see new scenarios on diploma examinations to which they are expected to apply their acquired knowledge and skills, but they should be assured their course work has prepared them to be able to interpret these new contexts, graphical or otherwise.

For a full listing of all the clarifications that have appeared over the last number of years, please see the archived bulletin.
Cognitive Expectations in the Program of Studies

Outcomes in the program of studies contain verbs that indicate the cognitive expectations of the outcome. Verbs typically classified under remembering/understanding (R/U) are coded yellow in the chart below; verbs typically classified under applying (A) are coded green; verbs typically classified as higher mental activities (HMA) are coded blue; and those relating to skills are coded pink.

The following graphic shows the same information arranged in a hierarchy, which is the arrangement used in the revised Bloom’s taxonomy.

The verbs arranged in the graphic shown above are only those that have been used in the Biology 30 Program of Studies. It is important to remember that the graphic should serve only as a guideline and that the verbs are not permanently fixed in the categories shown. A verb can indicate a variety of cognitive levels depending on the context in which it is used, and the two taken together are what determines the cognitive expectation.

Note that difficulty is independent of cognitive level. Outcomes at any of the three cognitive levels can be assessed at either the acceptable standard or the standard of excellence. Questions illustrating the updated cognitive-level categories appear at the end of this document.

# Examination Specifications and Design

Each Biology 30 Diploma Examination is designed to reflect the general outcomes outlined in the Biology 30 Program of Studies and is blueprinted to the same specifications. The general outcomes are expressed in more detail by the specific outcomes, which are organized into four units. Some questions on each diploma examination will assess achievement of particular outcomes, and other questions will be based on the integration of more than one outcome.

## General Outcomes

<table>
<thead>
<tr>
<th>General Outcomes</th>
<th>Emphasis</th>
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<tbody>
<tr>
<td>A1, A2</td>
<td><strong>Nervous and Endocrine Systems</strong>&lt;br&gt;Students will explain how the nervous system controls physiological processes and how the endocrine system contributes to homeostasis.</td>
</tr>
<tr>
<td>B1, B2</td>
<td><strong>Reproductive Systems and Hormones</strong>&lt;br&gt;Students will explain how survival of the human species is ensured through reproduction and how human reproduction is regulated by chemical control systems.</td>
</tr>
<tr>
<td>B3</td>
<td><strong>Differentiation and Development</strong>&lt;br&gt;Students will explain how cell differentiation and development in the human organism are regulated by a combination of genetic, endocrine, and environmental factors.</td>
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<tr>
<td>C1, C2</td>
<td><strong>Cell Division and Genetics</strong>&lt;br&gt;Students will describe the processes of mitosis and meiosis and will explain the basic rules and processes associated with the transmission of genetic characteristics.</td>
</tr>
<tr>
<td>C3</td>
<td><strong>Molecular Biology</strong>&lt;br&gt;Students will explain classical genetics at the molecular level.</td>
</tr>
<tr>
<td>D1, D2, D3</td>
<td><strong>Population and Community Dynamics</strong>&lt;br&gt;Students will describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time; explain the interaction of individuals with one another and with members of other populations; and explain, in quantitative terms, the changes in populations over time.</td>
</tr>
</tbody>
</table>
Most of the examination questions are context-based. This means questions are organized into sets related to contexts associated with topics in the program of studies.

Context-based questions are necessary to assess the cognitive expectations of the program of studies. Students should expect to see some biological contexts that are completely new to them. They can be confident that the knowledge, skills, and attitudes they acquired in Biology 30 have prepared them to address these questions.

The diploma exam is composed of questions at all three cognitive levels (R/U, A, and HMA); however, the majority of the questions in the examination are at an applying (A) level of cognition, because that is what is required by the program of studies.

All contexts and questions are validated for correctness by scientists with academic expertise in the topics covered in the Biology 30 Program of Studies.

Context-based questions require reading. The number of words in a Biology 30 examination has been tracked over time. The number of words in the examination increased with the January 2010 diploma examination, which coincided with the removal of the written-response portion. Since January 2010, however, the number of words has remained consistent.

The order of questions in a diploma examination typically follows the order of units in the program of studies; however, a question could appear on the examination within another unit if the context relates to outcomes in more than one unit.

Questions that require skill in applying scientific processes and questions that require science, technology, and society (STS) connections are distributed throughout the examination.

The design of the 2018–2019 Biology 30 Diploma Examinations is as follows:

<table>
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<tr>
<th>Question Format</th>
<th>Number of Questions</th>
<th>Percentage Emphasis</th>
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<tbody>
<tr>
<td>Multiple Choice</td>
<td>48</td>
<td>80</td>
</tr>
<tr>
<td>Numerical Response</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>

A particular context may be used for one or more multiple-choice questions; one or more numerical-response questions; or a combination of multiple-choice and numerical-response questions.

**Multiple-choice questions** are of two types: discrete and context dependent. A discrete question stands on its own without any additional directions or information. It may take the form of a question or an incomplete statement. A context-dependent question provides information that is separate from the question stem.

Most of the multiple-choice questions in the diploma examination are context dependent. If a context is provided on the diploma examination, then a student cannot properly address the question without reading the context. Students need to read contexts carefully.

Answers for multiple-choice questions are recorded in the first section of the machine-scored answer sheet.
Numerical-response questions are of several types, including these: calculating numerical values; expressing ratios; selecting structures, functions, or statements from a diagram or a list; matching structures, functions, or statements from a diagram or a list; and determining the sequence of listed events.

Specific instructions for recording answers for each type of numerical-response question are provided in the instructions pages of each Biology 30 Diploma Examination and with each question. Students are advised to pay close attention to specific instructions included with each question for recording answers on the answer sheet.

Answers for numerical-response questions are recorded in the second section of the machine-scored answer sheet.
Performance Expectations

Provincial performance standards help to communicate what students must be able to do to achieve the objectives specified in the Biology 30 Program of Studies. The specific statements of standards are written primarily to help Biology 30 teachers understand the extent to which students must know the required content and demonstrate the required skills in order to pass the examination.

Acceptable Standard

Students who achieve the acceptable standard in Biology 30 will receive a final course mark of 50% or higher. Students who achieve the acceptable standard demonstrate a basic understanding of the nature of scientific inquiry by performing, observing, and interpreting simple investigations. They can readily interpret data that are represented in simple graphs and tables and can translate symbolic representations into written descriptions. These students are able to identify structures on diagrams and describe their functions, and they are able to recognize and provide definitions for simple biological terms. They demonstrate a basic understanding of equilibrium and the control of homeostasis in the human body. They solve simple, quantitative genetics and ecology problems. These students can apply their understanding of some key biological concepts and technologies to straightforward but novel contexts. They can interpret information in new contexts to identify scientific, technological, and societal components of biological issues.

Standard of Excellence

Students who achieve the standard of excellence in Biology 30 will receive a final course mark of 80% or higher. In addition to meeting the expectations for the acceptable standard of performance, these students also demonstrate with confidence their aptitude and interest in biology. They design, analyze, and evaluate experimental designs. They readily interpret interrelated sets of data such as complex diagrams, graphs, and tables. These students provide specific and comprehensive explanations of concepts. They are able to integrate and apply their knowledge of biology to new and different contexts. They simultaneously apply two or more biological concepts that cross major themes. They demonstrate a thorough understanding of quantitative relationships and solve multistep numerical problems. They analyze complex and unique issues, including those related to current research. These students are aware of a variety of viewpoints relating to a variety of issues and perspectives in the field of science and technology.
*NEW* Trends in Student Performance

On the June 2017 and January 2018 Biology 30 diploma examinations, students showed that they are very good at addressing questions that require them to demonstrate basic knowledge of biology. Some students were challenged by questions requiring them to apply their acquired knowledge to new contexts, and others had difficulty with questions requiring them to integrate concepts across units. The vast majority of students were successful at interpreting various contexts related to science, technology, and society. What follows is a detailed breakdown by unit of students’ strengths and weaknesses as demonstrated by their achievement on the June 2017 and January 2018 diploma examinations.

**Unit A: Nervous and Endocrine Systems**

Students were easily able to identify the divisions of the nervous system; parts of a neuron; and structures of the brain, eye, and ear on diagrams. Many students were very successful at applying their knowledge of biology to new contexts, especially when they had to determine how an external factor or injury changed the functioning of certain neuron structures, the functioning of the brain and ear in relation to equilibrium, and the functioning of a reflex arc. Students had some difficulty matching structures of a neuron to their functions in a numerical-response question when they had to consider more than four structures; hypothesizing how an external factor would alter synaptic transmission; determining how an external factor specifically changes the electrochemical response; and determining that the electrochemical response in a neuron would increase in frequency in order to produce a more intense stimulus.

Students were generally very successful at identifying the names and locations of glands that secrete hormones, as well as the functions of most hormones, both on diagrams and in descriptions. They were particularly skilled at interpreting novel contexts related to the role and regulation of thyroxine. Although most students showed a high level of skill at interpreting data related to glucose concentrations in blood and in urine (C2.3s), many had difficulty interpreting a graph of glucose and glucagon levels to determine the diabetes status of two individuals. Many students showed they have a general understanding of hormones involved in response to stress, but they had difficulty determining an example of a physiological effect that would occur during short-term stress and long-term stress. In addition, some students had difficulty differentiating among characteristics of ACTH, cortisol, epinephrine, and aldosterone. Some students had difficulty differentiating the roles of ADH and aldosterone, including the glands that secrete those two hormones. Many students showed difficulty identifying the functions of PTH and calcitonin, in addition to interpreting a feedback loop of calcitonin.

**Unit B: Reproduction and Development**

Students were very successful at identifying structures of the male and female reproductive systems and describing their general functions, including the location of fertilization and the roles of accessory glands. Students had a some difficulty differentiating sperm and ova from surrounding structures. The most frequent mistakes made were confusing the follicle and the corpus luteum in the ovary; confusing the interstitial cells and Sertoli cells in the testis; and not identifying seminiferous tubules on a diagram as the location of spermatogenesis.

In general, students were able to identify the functions of reproductive hormones easily. Most students were able to apply their knowledge of LH and FSH to a new context and determine the
ultimate physiological effects of altering the secretion of these hormones. Students showed their proficiency at understanding the regulation of pituitary hormones through negative feedback as a result of high levels of ovarian hormones. Most students were able to predict the physiological effect of a hormone that exerts a negative feedback effect on FSH in males. Many students had difficulty drawing analogies between the effects of FSH and LH in the male and female reproductive systems, and some students had difficulty determining an effect of GnRH. Many students were very challenged by questions related to the interactions of hormones at a specific point in time in the menstrual cycle. Many students also had difficulty integrating a new context into their existing knowledge of the menstrual cycle.

Most students were able to describe the function of hCG in early pregnancy, and they showed good understanding of the concept of differentiation. However, they had difficulty determining the order of some events in early embryonic development, specifically from conception to gastrulation, and including the development of a zygote and a blastocyst. Students also were challenged by a numerical-response question in which they had to match four extra-embryonic structures with their descriptions. The most common mistake made was in mixing up the functions of the chorion and the allantois. Although students have shown good understanding about the structures that arise from each of the three embryonic germ layers, many had difficulty applying what they knew to a new context.

Unit C: Cell Division, Genetics, and Molecular Biology

Students showed that they understand the purposes and outcomes for the organism of different types of cell division. They also have a good general understanding of the events that take place during the cell cycle, including the main events of mitosis, cytokinesis, and interphase. However, some students had difficulty determining the specific phases of mitosis and meiosis in which some events occur; determining the behaviour or arrangement of chromosomes in a particular phase of cell division; analyzing descriptions of meiosis that referred to the number of chromosomal replications and cell divisions; and analyzing a microscope slide to determine phases of mitosis (C1.2s). Most students were able to interpret life-cycle diagrams for various organisms easily. If students had difficulties, they confused the processes of mitosis and meiosis in the diagram. Others had difficulty when they had to assign ploidies \((n, 2n)\) to structures in a life-cycle diagram. The most common misconception was that haploid structures are diploid, even when the life cycles show haploid structures developing from haploid spores. Some students had difficulty determining the ploidy of a zygote when given information about the ploidy of a somatic cell in the same organism or when given information about ploidy in the format of a karyotype. Students continued to show their capability at differentiating monozygotic from dizygotic twins and the ways in which these twins are produced.

Students continued to demonstrate a high level of skill at solving both simple and relatively complex genetics problems. In general, students are able to show their understanding in many different ways, given many different types of contexts and using many types of symbols. They were very successful at determining patterns of inheritance from descriptions, determining genotypes and phenotypes, calculating ratios, and calculating probabilities. They were also very capable at dealing with challenging concepts that include different types of inheritance, including codominance, gene interaction, X-linked alleles, and autosomal alleles. Although students were easily able to calculate phenotypic ratios in problems involving multiple alleles, some students were challenged by questions requiring them to differentiate incompletely dominant alleles and multiple alleles. Sometimes, students did not apply the product rule when necessary.
Most students were able to easily interpret simple pedigrees representing a given pattern of inheritance and calculate probabilities using the information in the pedigrees. Students had very little difficulty when interpreting chromosome maps. They were able to calculate map distances between genes and determine the order of genes on a chromosome quite easily. Students did have difficulty with selecting examples that illustrate Mendel’s laws of inheritance (C2.1k).

Students are typically very skilled at addressing questions related to the structure of DNA and the processes of transcription and translation. Most students were able to determine a mRNA sequence coded by a DNA sequence and identify the location where transcription and translation take place. They showed considerable proficiency at determining mRNA and amino acid sequences given a sequence of DNA. Some students were challenged by having to determine the DNA sequence that codes for a given amino acid chain, with the most common error being to determine the mRNA sequence and stop there rather than continuing to the DNA sequence. Some students were not able to identify the location where translation takes place, and some had difficulty determining the anticodons on tRNA molecules that transport given amino acids. Many students were able to show how a mutation affects the products of transcription and translation, although some found those questions challenging and approached the question by ignoring the mutation and coding the unmutated sequence. Students demonstrated a good general understanding of the roles of restriction enzymes and ligase in genetic recombination technology, although some students had difficulty applying their knowledge of restriction enzymes and ligase to a new context.

Unit D: Population and Community Dynamics

Students have demonstrated a good, basic understanding of factors affecting the Hardy–Weinberg equilibrium, especially the founder effect and the bottleneck effect. Some students had difficulty determining whether or not a population would be in Hardy–Weinberg equilibrium, given a description of the change in the frequency of a particular trait over time.

Students showed proficiency at being able to relate variables (e.g., $p$ and $q$) in the Hardy–Weinberg equation to genotypes of individuals in a population and at calculating frequencies requiring one or two steps (e.g., finding $2pq$ when given $q$). However, some students had difficulty calculating $p^2$ when given $q$, perhaps not realizing that $q$ represents unaffected individuals when the trait has autosomal dominant inheritance. Many students were challenged by Hardy–Weinberg questions requiring more steps or further reasoning, such as calculating the frequency of $p$ when given the number of people who do not have the disorder and the total number of people in the population.

Students were very proficient at interpreting contexts related to symbiotic relationships, competition, and environmental resistance; however, some students had difficulty determining how a density-independent growth factor would affect environmental resistance. Although many students successfully interpreted contexts related to ecological succession, some students had difficulty differentiating primary and secondary succession, and others had difficulty classifying species as being pioneer or climax species. Many students were very challenged by a context in which they had to relate succession taking place in a community to the reproductive strategies of the populations in that community.

Students easily addressed questions related to factors affecting the growth of a population and calculating growth rate of a population. Many students had difficulty with questions requiring them to determine per capita growth rate (cgr). The most common mistake students made was
to calculate growth rate instead. Students were very proficient at calculating the density of a population and understanding the relationship between density and competition.

In general, students were quite skilled at interpreting contexts to determine the reproductive strategies of organisms, and they were also able to easily recognize the shape of growth curves typically associated with those reproductive strategies. Students were very proficient at interpreting graphs of population growth and relating the shape of the graph to natality, mortality, carrying capacity, and whether population growth was positive or negative.
Assessment of STS Outcomes

Examination questions measure students’ understanding of biological concepts in the program of studies. Some questions have been designed to measure students’ understanding of the interrelationships between science and technology, as well as between science, technology, and society. Some STS outcomes are not as easily assessed on a machine-scored examination as others. The assumption is made that teachers are carrying out assessments and observations of STS outcomes with their students throughout the course. The appearance of questions on the diploma examination that assess STS outcomes should be expected.

The Biology 30 Program of Studies contains only 10 different STS outcomes, some of which are repeated in more than one unit.

Assessment of Skills Outcomes

Examination questions measure students’ understanding of biological concepts in the program of studies. Some questions also measure students’ development of the skills and thinking processes associated with scientific inquiry. Some skills outcomes are not as easily assessed on a machine-scored examination as others. The assumption is made that teachers are carrying out assessments and observations of skills outcomes with their students throughout the course. The development of skills outcomes is mandated by the program of studies, and, therefore, the appearance of questions on the diploma examination that assess these skills should be expected. Teachers are encouraged to consult the program of studies for a complete description of skills outcomes.

Assessment Standards

A document that describes standards of achievement appropriate to the Biology 30 Program of Studies was updated in 2016 and can be found on the Alberta Education website. The assessment standards document provides examples of some behaviours exhibited by students at the acceptable standard and at the standard of excellence. It should be used in conjunction with the program of studies, as it is not intended to replace the program of studies.

Assessment Exemplars

A document of Biology 30 assessment exemplars was updated in 2016. The assessment exemplars include multiple-choice and numerical-response questions and can be found on the Alberta Education website.
**Examination Development and Teacher Involvement**

High-quality diploma examinations are the product of close collaboration between classroom teachers and Alberta Education. Teachers from across Alberta are involved in many aspects of the examination process, including the writing of test items, the administering of field tests, and the reviewing and validating of diploma examinations.

The development of test items, from when they are written until when they appear on an examination, takes at least one year, if not longer. The writers of all items on diploma examinations are Biology 30 teachers from throughout Alberta. Items are field-tested to ensure their reliability and validity. Diploma examinations are reviewed by editors, a technical review committee that includes scientific experts from Alberta universities, a teacher validation committee, and a French validation committee.

Alberta Education values the involvement of teachers and asks school jurisdictions for the names of teachers who are interested in being involved in the development of diploma examinations. Teachers who would like to be involved in item writing, field-test construction, or the review and validation of examinations are encouraged to talk to their principals about how they can submit their names for approval to be involved in these processes. Although the call for submissions occurs in early September, teachers are welcome to have their names submitted at any time.

**Field Testing**

In Biology 30, year-end field tests are offered in both digital and hybrid formats.

Year-end field tests are available in two different lengths: one that takes 50 minutes of writing time, and one that takes 65 minutes of writing time. (Students are allowed an extra 15 minutes of writing time if it is available.)

An additional 10 minutes of administration time is required for each field-test administration period. Therefore, a class in which a Biology 30 field test is to be administered should be a minimum of 60 minutes long.

If your class periods are shorter than 60 minutes but you would like your students to participate in field testing, you can still request a field test if arrangements can be made in the school to provide students with an appropriate time period for the purposes of field testing.

Field tests can be scheduled either within class time or outside of class time up to two days in advance of the Biology 30 Diploma Examination.

For more information on requesting field tests, please refer to the Field Testing section of the General Information Bulletin.
Online Field Testing

All Grade 12 science and mathematics field tests are offered exclusively through the Quest A+ online delivery system. In addition to digital field tests, hybrid field tests are also available this school year. With a hybrid field test, students receive a paper copy of the readings or sources. However, students must respond to the questions online.

Students should use paper data booklets, data pages, or formula sheets for all science and mathematics field tests. These resources will also appear in the online delivery system. Students should also have scrap paper, which may be accessed and downloaded from the Teacher Resources section on the home page of the Field Test Request System. All paper data sheets or scrap paper with markings must be securely shredded at the end of the field-test administration.

Teachers have a 24-hour window to peruse the digital or hybrid field test and are provided with data on how their students performed. These data include the proportion of students who chose each alternative on multiple-choice items and the proportion who left a numerical-response item blank. Test items are blueprinted to program of studies outcomes. This allows teachers to use field test results to learn more about their students’ strengths and weaknesses.

Once logged into the digital or hybrid field test, teachers have the same length of time to peruse the test as their students did to write it. Teachers might choose to log into the field test, submit the confidentiality form, and then log out of the test so that they can finish perusing the test after receiving their students’ data.

In addition, teachers have greater flexibility in selecting the time and date when students write, rather than being bound to a pre-determined date.

Finally, online administration enables every school, large or small, to participate. Historically, it was impractical to send field-test administrators to remotely located schools or schools with small classes. Now, all Alberta schools can participate in field tests.

It is important to note that the security of field test items remains vital to the administration of diploma examinations. Participating teachers must commit to maintaining the security of field-test items. In the case of hybrid field tests, paper copies are mailed to schools and the questions are accessed in the same format as digital-format field tests. Prior to the hybrid field test, the paper copies must be kept secure by the school principal. After the administration of a hybrid-format field test, teachers must mail all paper copies back to Alberta Education.
Benefits of Field Tests

How do field tests help teachers and students?

Teachers receive each student’s score promptly, gaining useful immediate information about their students’ levels of expertise and knowledge. Students also benefit from writing a test that duplicates some of the experience of writing a diploma examination. Field tests provide students and teachers with good examples of the style and content of questions that may appear on diploma examinations. Finally, because of field testing, students, teachers, and parents can be reassured that the questions on diploma examinations have undergone a rigorous process of development, improvement, and validation.

Why are field tests necessary?

Field testing is an absolutely essential stage in the development of fair, valid, and reliable provincial examinations. Field testing is basically a process of “testing a test” and “testing questions” before they become part of a diploma examination. Potential diploma examination questions are administered to students in diploma courses throughout the province to determine their difficulty level and appropriateness. Ideally, each field test requires a large student sample to provide the examination developers with reliable information (statistical data and written validation comments from teachers and students).

How are field test data used?

The data received from field tests show the reliability of each question. Sometimes, after one field test round, it is clear that certain questions work very well in terms of fairness, validity, and appropriateness to course content. These questions then move into the diploma examination bank to be used at a future date.

Other questions or sets of questions may not perform as well as we require. These questions are subject to revision and review, and then retested in a second or third field test with the aim of generating questions that meet our standards. These changes are influenced by the written comments of students and teachers, who provide valuable advice about the appropriateness of the questions, writing time limits, test length, text readability, artwork/graphics clarity and suitability, and question difficulty.
Further Information

Teachers requesting field tests must have a Public Authentication System (PAS) account. All requests are made through the Field Test Request System. Further information, including the closing dates to request a field test, may be obtained by contacting Field.Test@gov.ab.ca, or from the General Information Bulletin. Practice tests are available online.

For more information, contact

Deanna Shostak  
Director, Diploma Programs  
780-422-5160 or Deanna.Shostak@gov.ab.ca

or

Pascal Couture  
Director, Exam Administration and Production  
780-492-1462 or Pascal.Couture@gov.ab.ca

Special-format Practice Tests

To provide students an opportunity to practise diploma examination-style questions and content in Braille, audio, large print, or coloured print versions, Alberta Education is making special-format practice tests available. Tests are offered in all subjects with a corresponding diploma examination. Alberta schools with registered Alberta K-12 students may place orders for these tests. Braille tests are available in English and, by request, in French. All tests are provided free of charge, but limits may be placed on order volumes to ensure access for everyone.

For more information or to place an order, contact

Laura LaFramboise  
Distribution Coordinator, Exam Administration  
780-492-1644 or Laura.LaFramboise@gov.ab.ca
**Examination Security**

All Biology 30 diploma examinations will be held secure until they are released to the public by the minister. No secure diploma examination is to be previewed, copied, or discussed. All examination materials must remain secured after their administration.

For the January and June examinations, teachers whose students are writing the examination will be allowed access to a digital teacher perusal copy for review purposes one hour after the examination has started. For more information about teacher perusal copies and examination security, please refer to the General Information Bulletin.

**Maintaining Consistent Standards Over Time on Diploma Examinations**

A goal of Alberta Education is to make scores achieved on examinations within the same subject directly comparable from session to session, thereby enhancing fairness to students across administrations.

In order to achieve this goal, the examination has a number of questions in common with a previous examination. Common items are used to find out if the student population writing in one administration differs in achievement from the student population writing in another administration. Common items are also used to find out if the unique items (questions that have never appeared in a previous examination) differ in difficulty from the unique items on the baseline examination, setting the standard to which all students are held.

A statistical process called equating adjusts for differences in difficulty between examinations. Examination marks may be adjusted depending upon the difficulty of the examination written relative to the baseline examination. Therefore, the resulting equated examination scores have the same meaning regardless of when and to whom the examination was administered. Equated diploma examination marks are reported to students. More information about equating is available here.

Because of the security required to enable fair and appropriate assessment of student achievement over time, Biology 30 diploma examinations will be fully secured and will not be released at the time of writing.
Publications and Supporting Documents

The following documents are published by Alberta Education:

- **Biology 30 Information Bulletin** updated version available by August prior to each school year.
- **Biology 30 Archived Bulletin** updated version available by August 2018
- **Biology 30 assessment exemplars** updated in fall 2016
- **Biology 30 assessment standards** updated in fall 2016
- **Diploma exam results**
- **Released Materials** most recent version published in fall 2017, which consists of a selection of items from the January 2017 Form 2 Diploma Examination

Biology Data Pages

Biology tear-out data pages are included at the back of the diploma examination booklet. These data pages are available on the Alberta Education website.

- **Biology 30 Data Booklet** available on education.alberta.ca

Students should be familiar with the data pages before writing the diploma examination.

Using Calculators

The Biology 30 Diploma Examination requires the use of an approved calculator. The calculator policy, calculator criteria, expectations, and keystrokes required for clearing approved calculators can be found in the **General Information Bulletin** on the Alberta Education website.

- **Graphing Calculator Policy** available on education.alberta.ca
Preparation Materials for Students

Materials that could help students prepare for the Biology 30 Diploma Examination include the following:

- Guide for Students
- Biology Data Booklet
- Biology 30 Diploma Exam Exemplars
- Biology 30 Diploma Exam Assessment Standards
- Biology 30 2017 Released Items
- Online Practice Tests – Biology 30. The year-end practice test, 2007 Released Items, 2009 Released Items, 2011 field-tested items, and 2014 Released Items available on Quest A+ include a formative element. Students can click on a button to view information explaining why an alternative is correct or incorrect. They can also view the cognitive level that corresponds to a particular question.
Sample Questions Illustrating Cognitive Level

This section contains examples of questions that illustrate different cognitive levels.

Remembering/Understanding (R/U) Level

Olfaction is the sense that enables organisms to distinguish and interpret odours. An action potential is initiated when a chemical interacts with an odour-receptor protein in the cell membrane of a sensory neuron in the nasal cavity.

The area of the brain where odours are interpreted is the

A. cerebrum
B. cerebellum
C. hypothalamus
D. medulla oblongata

Answer: A
Outcome: A1.2k
Cognitive level: R/U (remembering)
Which of the following rows identifies Gland 1, Gland 2, Hormone X, and Hormone Y, as shown in the diagram above?

<table>
<thead>
<tr>
<th>Row</th>
<th>Gland 1</th>
<th>Gland 2</th>
<th>Hormone X</th>
<th>Hormone Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Pituitary gland</td>
<td>Hypothalamus</td>
<td>LH</td>
<td>GnRH</td>
</tr>
<tr>
<td>B.</td>
<td>Hypothalamus</td>
<td>Pituitary gland</td>
<td>GnRH</td>
<td>LH</td>
</tr>
<tr>
<td>C.</td>
<td>Hypothalamus</td>
<td>Pituitary gland</td>
<td>GnRH</td>
<td>FSH</td>
</tr>
<tr>
<td>D.</td>
<td>Pituitary gland</td>
<td>Hypothalamus</td>
<td>FSH</td>
<td>GnRH</td>
</tr>
</tbody>
</table>

Answer: B
Outcomes: B2.3k, B2.1k
Cognitive level: R/U (understanding)
Applying (A) Level

<table>
<thead>
<tr>
<th>Ecological Relationship</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Predator–prey</td>
<td>An interaction where members of the same species compete for the same resources.</td>
<td>Aggressive salamanders are more successful at obtaining food compared to less aggressive salamanders.</td>
</tr>
<tr>
<td>2 Interspecific Competition</td>
<td>A relationship in which an organism kills and consumes another organism.</td>
<td>Squirrels and chipmunks compete for acorns.</td>
</tr>
<tr>
<td>3 Intraspecific Competition</td>
<td>An interaction where members of different species compete for the same resources.</td>
<td>A female lion hunts and captures a zebra and brings the food back to its pride.</td>
</tr>
</tbody>
</table>

**Numerical Response**

Using the numbers above, choose one ecological relationship and match it with the definition associated with that ecological relationship and with an example that represents both the description and the ecological relationship. (There is more than one correct answer.)

Ecological relationship: __________ (Record in the first box)
Definition: __________ (Record in the second box)
Example: __________ (Record in the third box)

(Record all three digits of your answer in the response boxes at the bottom of the screen.)

Answer: 159, 268, 347
Outcomes: D2.1k
Cognitive level: A
The eumelanin gene determines coat colour in dogs. The dominant allele \((E)\) produces a black coat, and the recessive allele \((e)\) produces a red coat. The merle gene controls the expression of colour. The merle alleles are incompletely dominant, as shown below.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Phenotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>(mm)</td>
<td>Full colour (either black or dark red)</td>
</tr>
<tr>
<td>(Mm)</td>
<td>Dilute colour (either grey or light red)</td>
</tr>
<tr>
<td>(MM)</td>
<td>White</td>
</tr>
</tbody>
</table>

The eumelanin and merle genes are located on two different autosomes.

A grey dog that is homozygous dominant for eumelanin mates with a dark red dog. The phenotypes that are possible in their offspring are

A. grey and black  
B. black and white  
C. grey and dark red  
D. dark red and black

Answer: A  
Outcomes: C2.2k, C2.3s  
Cognitive level: A
A mutation in the connexin 26 gene involves the deletion of two bases and their replacement by two new bases. The deletion is shown below.

\[ \text{ATC} \]

\text{Deleted bases}

The two deleted bases are replaced by two adenine bases.

—based on Human Gene Mutation Database, 2010

The transcription of the mutated connexin 26 gene described above results in the replacement of a

A. stop codon with a lysine codon
B. methionine codon with a lysine codon
C. stop codon with a phenylalanine codon
D. methionine codon with a phenylalanine codon

Answer: C
Outcomes: C3.6k, C3.3k, and C3.2s
Cognitive level: A
A contraceptive implant has been developed for male dogs. The implant releases a drug called deslorelin.

**Some Statements Related to the Use of Deslorelin**

1. Administering deslorelin for a short period of time costs less than neutering a male dog.
2. Researchers hypothesize that deslorelin could be used to control the populations of some wild animals.
3. Veterinarians are concerned that the manipulation of hormones with deslorelin will increase the incidence of cancer in dogs.
4. Using deslorelin to decrease reproduction in dogs could decrease the need for organizations like the SPCA and other humane organizations.

**Numerical Response**

Match each statement related to the use of deslorelin with the consideration that describes it given below.

<table>
<thead>
<tr>
<th>Statement:</th>
<th>Consideration:</th>
<th>Societal</th>
<th>Technological</th>
<th>Economic</th>
<th>Ecological</th>
</tr>
</thead>
</table>

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Answer: 4312
Outcomes: B3.5k and B2.2sts
Cognitive level: A
The Venn diagram below shows the relationship between oogenesis and spermatogenesis.

The Venn diagram shows:

- **Oogenesis**
  - 1
  - 2

- **Spermatogenesis**
  - 3

Numerical Response

Match the numbered regions of the Venn diagram with the descriptions below. (A number may be used more than once.)

<table>
<thead>
<tr>
<th>Number:</th>
<th>Description:</th>
<th>Four daughter cells produced</th>
<th>Unequal cytoplasmic division</th>
<th>Stimulated by FSH</th>
<th>Daughter cells equal in size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Record all four digits of your answer in the numerical-response section on the answer sheet.)

Answer: 2123 or 3123
Outcomes: C1.3k
Cognitive level: A
Higher Mental Activities (HMA) Level

Adult butterflies are diploid. The sex chromosomes in adult female butterflies are W and Z chromosomes, whereas the sex chromosomes in adult male butterflies are two Z chromosomes.

A karyotype of Structure 1 in the diagram above would have

A. two copies of each autosome and two Z chromosomes
B. one copy of each autosome and either a W or a Z chromosome
C. one copy of each autosome, a W chromosome, and a Z chromosome
D. two copies of each autosome, a W chromosome, and a Z chromosome

Answer: B
Outcomes: C1.7k and C1.3s
Cognitive level: HMA (analyzing)
Dentinogenesis imperfecta is a condition associated with thin tooth enamel and discoloured teeth. A student used the pedigree below to identify the mode of inheritance of dentinogenesis imperfecta. The student believes that dentinogenesis imperfecta is inherited in an autosomal recessive pattern.

A Pedigree Showing the Inheritance of Dentinogenesis Imperfecta

The student’s identification of the mode of inheritance of dentinogenesis imperfecta as autosomal recessive is

A. correct; it is autosomal recessive because individual I-1 is a carrier and has an unaffected child
B. incorrect; it is X-linked recessive because individual II-7 passes the condition on to his son
C. incorrect; it is X-linked dominant because individual I-2 passes the condition on to her daughter
D. incorrect; it is autosomal dominant because individuals II-3 and II-4 have an unaffected child

Answer: D
Outcomes: C2.2k and C2.3s
Cognitive level: HMA (evaluating)
Contacts 2018–2019

Provincial Assessment Sector
Dan Karas, Executive Director
Provincial Assessment Sector
780-422-4848
Dan.Karas@gov.ab.ca

Diploma Programs
Deanna Shostak, Director
Diploma Programs
780-422-5160
Deanna.Shostak@gov.ab.ca

French Assessment
Gilbert Guimont, Director
French Assessment
780-422-3535
Gilbert.Guimont@gov.ab.ca

Exam Managers
Gary Hoogers
English Language Arts 30–1
780-422-5213
Gary.Hoogers@gov.ab.ca

Philip Taranger
English Language Arts 30–2
780-422-4478
Philip.Taranger@gov.ab.ca

Monique Bélanger
Français 30–1, French Language Arts 30–1
780-422-5140
Monique.Belanger@gov.ab.ca

Dwayne Girard
Social Studies 30–1
780-422-5161
Dwayne.Girard@gov.ab.ca

Patrick Roy
Social Studies 30–2
780-422-4631
Patrick.Roy@gov.ab.ca

Shannon Mitchell
Biology 30
780-415-6122
Shannon.Mitchell@gov.ab.ca

Brenda Elder
Chemistry 30
780-427-1573
Brenda.Elder@gov.ab.ca

Delcy Rolheiser
Mathematics 30–1
780-415-6181
Delcy.Rolheiser@gov.ab.ca

Jenny Kim
Mathematics 30–2
780-415-6127
Jenny.Kim@gov.ab.ca

Marc Kozak
Physics 30, Examiner
780-427-6196
Marc.Kozak@gov.ab.ca

Stan Bissell
Science 30
780-422-5730
Stan.Bissell@gov.ab.ca

Pascal Couture, Director
Exam Administration and Production
780-492-1462
Pascal.Couture@gov.ab.ca

Pamela Klebanov, Senior Manager
Business Operations and Special Cases
780-492-1443
Pamela.Klebanov@gov.ab.ca

Steven Diachuk, Coordinator
Field Testing, Special Cases, and GED
780-492-1453
Steven.Diachuk@gov.ab.ca

Inquiries about special cases, achievement test accommodations, and special-format materials can be sent by email to special.cases@gov.ab.ca

Inquiries about field testing can be sent by email to field.test@gov.ab.ca

Provincial Assessment Sector
Mailing Address
Provincial Assessment Sector, Alberta Education
44 Capital Boulevard
10044 108 Street NW
Edmonton AB T5J 5E6
Telephone: 780-427-0010
Toll-free within Alberta: 310-0000
Fax: 780-422-4200
Alberta Education website:
education.alberta.ca