Information Bulletin

Biology 30

Diploma Examinations Program 2020–2021

Some information in this document may be subject to change due to COVID-19. See the Alberta Education website for updates.
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Please note that if you cannot access one of the direct website links referred to in this document, you can find diploma examination-related materials on the Alberta Education website.
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Introduction

The purpose of this bulletin is to provide teachers of Biology 30 with information about the diploma examinations scheduled in the 2020-2021 school year. This bulletin should be used in conjunction with the current Biology 30 Program of Studies.

This bulletin includes descriptions of the Biology 30 Diploma Examinations that will be administered in November 2020 and January, April, June, and August 2021; clarifications of some aspects of the examinations; descriptions of trends in student performance on previous examinations; and other subject-specific information.

Teachers are encouraged to share the information in this bulletin with their students.
**Examination Security**

All diploma examinations will be held secure until they are released to the public by the Minister. No secure diploma examination is to be previewed until it is released to the public by the Minister. No secure diploma examination is to be previewed, discussed, copied, or removed from the room in which the examination is being written.

The perusal of diploma examinations is **not permitted for any exam administration in 2021**. Perusal copies will not be provided for the January 2021 or June 2021 administrations.

For mathematics and science diploma exams: All diploma examination booklets must be kept secure, without exception.

For humanities diploma exams: All diploma examination booklets, including humanities Part A: Written Response, must be kept secure, without exception.

All diploma exam booklets, including unused copies of all diploma exams, must be returned to Alberta Education as per the dates indicated in the [Schedule of Significant Dates](#).

For more information about examination security, please refer to the [General Information Bulletin](#).

**Time Limits on Diploma Examinations**

All students may use extra time to write diploma examinations. This means that all students have up to 6 hours to complete the Biology 30 Diploma Examination, if they need it. **The examination is nevertheless designed so that the majority of students can complete it within 3 hours.** The examination instructions state both the designed time and the total time 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](#).
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, to ensure fairness to students across administrations.

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 that sets 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 ensure 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.
Diploma Examinations: Multiple Forms

As part of Alberta Education’s commitment to fairness to students and flexibility in the writing of diploma examinations, there may be two distinct forms (versions) of diploma examinations in some subjects during major administrations (January and June). The two forms are equated to baseline examinations to ensure that the same standard applies to both forms. Both forms adhere to the established blueprint specifications and are reviewed by a technical review committee.

To facilitate the analysis of school-level results, each school receives only one examination form per subject. In subjects offering a translated French-language examination, both forms are administered in English and in French.

For more information, contact

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

or

Pascal Couture
Director, Exam Administration
780-643-9157 or Pascal.Couture@gov.ab.ca
Field Testing

Field testing is an essential stage in the development of fair, valid, and reliable provincial examinations. Field testing is a process of collecting data on 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 the difficulty level and appropriateness of the questions. 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 do field tests help teachers and students?

Teachers receive each student’s score promptly, gaining useful information about their students’ performance. Students benefit from writing a test that duplicates some of the experience of writing a diploma examination. Field tests provide students and teachers with examples of the format 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.

How are field-test data used?

The data received from field tests indicate the validity, reliability, and fairness of each question. Questions that meet specific standards are selected for use on future diploma examinations.

Some questions or sets of questions may not initially perform as well as we require. These questions may be revised and field tested again. Revisions are influenced by the written comments of students and teachers, who provide valuable advice about the appropriateness of the questions, adequacy of writing-time limits, test length, text readability, artwork/graphics clarity and suitability, and question difficulty.

Science field tests

All Grade 12 science field tests are offered exclusively through the Quest A+ online delivery system. These include purely digital field tests; and hybrid field tests, in which students receive a paper copy of the test but must respond to the questions online.

Students should use paper data booklets or data pages for all science 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 period to peruse digital or hybrid field tests and are provided with data on how their students performed. These data include the proportion of students who chose each alternative for multiple-choice items and the proportion who left a numerical-response item blank. Test items are blueprinted to program of studies outcomes, which allows teachers to use field-test results to learn more about their students’ strengths and areas for improvement.
Once logged into the digital or hybrid field test on the online delivery system, 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.

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 must be kept secure by the school principal until administration. After the administration of a hybrid field test, all paper copies must be mailed back to Alberta Education.

More information about field-test registration deadlines, administration, and security is available here.

**How can teachers request field tests?**

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 and administer a field test, may be obtained here, or by contacting Field.Test@gov.ab.ca.

**For more information, contact**

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

or

Pascal Couture  
Director, Exam Administration  
780-643-9157 or Pascal.Couture@gov.ab.ca
Biology 30 Field Testing

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.)

*NEW In addition, four unit tests are offered in digital format:

- Unit A: Nervous and Endocrine Systems
- Unit B: Reproduction and Development
- Unit C: Cell Division, Genetics, and Molecular Biology
- Unit D: Populations and Communities

Each unit test is designed to take 50 minutes of writing time and has approximately 20 to 25 questions. As a result, the entire unit may not be covered on a particular unit test.

For all field tests, 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.

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 provided arrangements can be made in the school to give students an appropriate time for the field test.

Field tests can be scheduled either within class time or outside of class time up to the day before the Biology 30 Diploma Examination.

For more information on requesting field tests, please refer to the Field Testing Program Rules, Procedures and Request Guide.
Practice Tests

To give students an opportunity to practise diploma examination-style questions and content, Alberta Education produces practice tests for most subjects that have a diploma examination. Students can access these practice tests using Alberta Education’s online test delivery system.

Special-format Practice Tests

To give students an opportunity to practise diploma examination-style questions and content in Braille, audio, large print, or coloured print versions, Alberta Education produces special-format practice tests for all subjects that have a diploma examination. Alberta schools with registered Alberta K–12 students may place orders for these tests. Braille versions 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 all students.

For the greatest benefit, special-format practice tests should be written under conditions similar to those of the corresponding diploma examination. The same rules regarding the use of resources and devices should be followed.

Braille versions must be returned to Alberta Education after use.

For more information or to place an order, contact

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

*NEW Audio Descriptions

Examples of Descriptions Used in Audio Versions of Science Diploma Exams has been developed to assist teachers and students planning to use an audio version during the administration of a diploma examination and is available on the Alberta Education website.
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.

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 on the Alberta Education website.
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.

*Verbs can have multiple connotations and can therefore indicate more than one cognitive level. The cognitive expectation is communicated by the context.*


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.
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 definition 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
Outcome: 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, and they produce offspring.

The phenotypes that are possible in the offspring of the two parent dogs described above 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.

\[ \text{Deleted bases} \]

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: 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.

**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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Four daughter cells produced</td>
</tr>
<tr>
<td>2</td>
<td>Unequal cytoplasmic division</td>
</tr>
<tr>
<td>3</td>
<td>Stimulated by FSH</td>
</tr>
<tr>
<td></td>
<td>Daughter cells equal in size</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
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 determines that dentinogenesis imperfecta is inherited in an autosomal recessive pattern.

A Pedigree Showing the Inheritance of Dentinogenesis Imperfecta

![Pedigree Diagram]

Which of the following rows best evaluates the correctness of the student’s identification of the pattern of inheritance displayed in the pedigree and explains why?

<table>
<thead>
<tr>
<th>Row</th>
<th>Evaluates</th>
<th>Explains</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Correct</td>
<td>Pattern is autosomal recessive, because individual I-1 is a carrier and has an unaffected child</td>
</tr>
<tr>
<td>B.</td>
<td>Incorrect</td>
<td>Pattern should be X-linked recessive, because individual II-7 passes the condition on to his son</td>
</tr>
<tr>
<td>C.</td>
<td>Incorrect</td>
<td>Pattern should be X-linked dominant, because individual I-2 passes the condition on to her daughter</td>
</tr>
<tr>
<td>D.</td>
<td>Incorrect</td>
<td>Pattern should be autosomal dominant, because individuals II-3 and II-4 have an unaffected child</td>
</tr>
</tbody>
</table>

Answer: D  
Outcomes: C2.2k and C2.3s  
Cognitive level: HMA (evaluating)
Performance Expectations

Curriculum standards
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.
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 several outcomes.

<table>
<thead>
<tr>
<th>General Outcomes</th>
<th>Units of Study</th>
<th>Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1, A2</td>
<td>Nervous and Endocrine Systems</td>
<td>20–25%</td>
</tr>
<tr>
<td></td>
<td>Students will explain how the nervous system controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>physiological processes and how the endocrine system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>contributes to homeostasis.</td>
<td></td>
</tr>
<tr>
<td>B1, B2</td>
<td>Reproductive Systems and Hormones</td>
<td>10–15%</td>
</tr>
<tr>
<td></td>
<td>Students will explain how survival of the human species</td>
<td></td>
</tr>
<tr>
<td></td>
<td>is ensured through reproduction and how human</td>
<td></td>
</tr>
<tr>
<td></td>
<td>reproduction is regulated by chemical control systems.</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Differentiation and Development</td>
<td>5–10%</td>
</tr>
<tr>
<td></td>
<td>Students will explain how cell differentiation and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>development in the human organism are regulated by a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>combination of genetic, endocrine, and environmental</td>
<td></td>
</tr>
<tr>
<td></td>
<td>factors.</td>
<td></td>
</tr>
<tr>
<td>C1, C2</td>
<td>Cell Division and Genetics</td>
<td>25–30%</td>
</tr>
<tr>
<td></td>
<td>Students will describe the processes of mitosis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and meiosis and will explain the basic rules and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>processes associated with the transmission of genetic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>characteristics.</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Molecular Biology</td>
<td>10–15%</td>
</tr>
<tr>
<td></td>
<td>Students will explain classical genetics at the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>molecular level.</td>
<td></td>
</tr>
<tr>
<td>D1, D2, D3</td>
<td>Population and Community Dynamics</td>
<td>15–20%</td>
</tr>
<tr>
<td></td>
<td>Students will describe a community as a composite of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>populations in which individuals contribute to a gene</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pool that can change over time; explain the interaction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of individuals with one another and with members of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>other populations; and explain, in quantitative terms,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the changes in populations over time.</td>
<td></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 content areas 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 2020-2021 Biology 30 Diploma Examinations is as follows:

<table>
<thead>
<tr>
<th>Question Format</th>
<th>Number of Questions</th>
<th>Percentage Emphasis</th>
</tr>
</thead>
<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.
Biology 30 Instructions Pages

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August 2020

Biology 30

Grade 12 Diploma Examination

Description

Time: 3 hours. This closed-book examination was developed to be completed in 3 hours; however, you may take up to 6 hours to complete the examination, should you need it.

This examination consists of 48 multiple-choice and 12 numerical-response questions, of equal value.

This examination contains sets of related questions. A set of questions may contain multiple-choice and/or numerical-response questions.

Tear-out data pages are included near the back of this booklet.

Instructions

• Use only an HB pencil for the answer sheet.
• Fill in the information on the back cover of the examination booklet and the answer sheet as directed by the presiding examiner.
• You are expected to provide your own calculator. You may use any scientific calculator that does not have prohibited properties or graphing calculator approved by Alberta Education.
• You must have cleared your calculator of all information that is stored in the programmable or parametric memory.
• You may use a ruler and a protractor.
• Read each question carefully.
• Consider all numbers used in the examination to be the result of a measurement or an observation.
• If you wish to change an answer, erase all traces of your first answer.
• Do not fold the answer sheet.
• The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Education.
• Now read the detailed instructions for answering machine-scored questions.

Note: Additional tear-out pages at the back of this booklet may be used for your rough work. No marks will be given for work done on the tear-out pages.
**Multiple Choice**

- Decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

**Example**

This examination is for the subject of

A. chemistry  
B. biology  
C. physics  
D. science

Answer: B

Record B on the answer sheet:  

**Numerical Response**

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.
- If an answer is a value between 0 and 1 (e.g., 0.25), then be sure to record the 0 before the decimal place.
- Enter the first digit of your answer in the left-hand box. Any boxes on the right that are not needed are to remain blank.

**Examples**

**Calculation Question and Solution**

The average of the values 21.0, 25.5, and 24.5 is _________.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

Answer: 23.7
Sequencing Question and Solution

Four Subjects

1. Physics
2. Biology
3. Science
4. Chemistry

When the subjects above are arranged in alphabetical order, their order is ____., ____., and ____.

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

Answer: 2413

Selection Question and Solution

Five Subjects

1. Art
2. Music
3. Physics
4. Biology
5. Chemistry

The science subjects in the list above are numbered ____., ____., and ____.

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

Answer: 345

Note: All answers containing only the three digits 3, 4, and 5, in any order, will be scored as correct.
**Ratio Question and Solution**

A collection of marbles includes eight green marbles, four blue marbles, and two white marbles.

What is the colour ratio of the marbles in the collection?

**Ratio:** _______ : _______ : _______

**Colour:** Green  Blue  White

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

Answer: 421

Record 421 on the answer sheet

**Multiple-answer Matching Question and Solution**

<table>
<thead>
<tr>
<th>Continent</th>
<th>Country</th>
<th>Capital City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 North America</td>
<td>4 France</td>
<td>7 Beijing</td>
</tr>
<tr>
<td>2 Europe</td>
<td>5 China</td>
<td>8 Ottawa</td>
</tr>
<tr>
<td>3 Asia</td>
<td>6 Canada</td>
<td>9 Paris</td>
</tr>
</tbody>
</table>

Using the numbers above, choose one continent and match it with a country in that continent and with that country’s capital city. (There is more than one correct answer.)

**Number:** _______ _______ _______

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

Answer: 168 or 249 or 357

Record 168 on the answer sheet

Note: The answers 168, 249, or 357 will be scored as correct.
Assessment of STS Outcomes

Examination questions assess students’ understanding of biological concepts in the program of studies. Some questions have been designed to assess 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

Some questions also assess 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.
**NEW**

Trends in Student Performance

On the June 2019 and January 2020 Biology 30 diploma examinations, students showed that they are very good at addressing questions requiring 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 skilled at interpreting contexts related to experimental design, including describing hypotheses, identifying variables, and drawing conclusions from data.

What follows are descriptions of students’ performance as demonstrated by their achievement on the June 2019 and January 2020 diploma examinations. Areas of strength and areas of difficulty are described in point form, grouped broadly by topic into rows. The most common errors are described when they are apparent. The descriptions of errors appear in italicized text in the third column to emphasize that they reflect incorrect biology.
## Unit A: Nervous and Endocrine Systems

<table>
<thead>
<tr>
<th>Areas of Strength</th>
<th>Areas of Difficulty</th>
<th>Most Common Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identifying parts of the neuron and descriptions of their functions</td>
<td>• Identifying the sensory neuron from a description and then classifying it into a division of the nervous system</td>
<td>• Some students classified sensory neurons as being in the CNS.</td>
</tr>
<tr>
<td>• Interpreting a context to identify on a diagram the part of the brain affected</td>
<td>• Recognizing the effects of the somatic nervous system</td>
<td>• Some students confused the role of the central nervous system with that of the somatic nervous system.</td>
</tr>
<tr>
<td>• Differentiating the cerebrum from the cerebellum on a diagram and identifying their functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Recognizing effects of the sympathetic nervous system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Hypothesizing the effect of a chemical on cholinesterase and the functioning of the synapse</td>
<td>• Recognizing the effects of the sympathetic nervous system</td>
<td>• Some students thought a cholinesterase inhibitor would decrease post-synaptic transmission.</td>
</tr>
<tr>
<td>• Applying knowledge of depolarization to a new context</td>
<td>• Interpreting a diagram of a sodium–potassium pump to determine ion movement and the effect on the neural membrane</td>
<td>• Some students thought the role of the sodium–potassium pump is to stimulate an action potential by pumping sodium into the neuron instead of to establish the resting membrane potential.</td>
</tr>
<tr>
<td>• Understanding that the opening of sodium channels stimulates an action potential</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>-------------------</td>
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<td>--------------------</td>
</tr>
<tr>
<td>• Interpreting diagrams of a reflex arc to label the parts</td>
<td>• Interpreting a context describing an altered reflex response to determine where damage occurred</td>
<td>• Some students mistook the sensory neuron for the motor neuron in a reflex-arc diagram.</td>
</tr>
<tr>
<td>• Understanding how parts of a reflex arc work together to elicit a response</td>
<td></td>
<td>• Some students attributed symptoms of sensory-neuron damage to a damaged interneuron.</td>
</tr>
<tr>
<td>• Interpreting contexts related to diseases of the eye and the ear to determine the specific structures affected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Differentiating the functions of rod cells and cone cells</td>
<td></td>
<td>• Some students thought the cochlea stimulates the ossicles rather than the auditory nerve.</td>
</tr>
<tr>
<td>• Differentiating between ear structures that relate to hearing and those that relate to equilibrium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Identifying the functions of most hormones</td>
<td>• Describing the metabolic effect of PTH</td>
<td>• Some students thought PTH plays a role in metabolism.</td>
</tr>
<tr>
<td>• Identifying on a diagram the glands that secrete PTH</td>
<td>• Determining whether calcitonin causes movement of calcium into or out of bones</td>
<td></td>
</tr>
<tr>
<td>• Understanding that calcitonin decreases blood-calcium level</td>
<td>• Choosing from a list the expected effects of an imbalance of thyroxine</td>
<td>• Some students chose effects of thyroxine from a list rather than those resulting from an imbalance of thyroxine.</td>
</tr>
<tr>
<td>• Understanding that the thyroid gland plays a role in metabolism</td>
<td>• Interpreting a context to determine the negative-feedback effect of a drug on thyroid regulation</td>
<td></td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>-------------------</td>
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<td>-------------------</td>
</tr>
<tr>
<td>• Identifying epinephrine and cortisol as hormones involved in the stress response</td>
<td>• Differentiating functions of cortisol, aldosterone, and ACTH</td>
<td>• Some students mixed up the functions of ACTH and cortisol; others, the functions of aldosterone and cortisol.</td>
</tr>
<tr>
<td>• Describing physiological effects of epinephrine</td>
<td>• Determining effects of an ADH imbalance</td>
<td>• Some students thought a decrease in ADH results in more concentrated rather than more dilute urine.</td>
</tr>
<tr>
<td>• Interpreting a scientific investigation related to stress and cortisol</td>
<td>• Interpreting experimental data related to aldosterone, cortisol, and ADH to determine effects on blood pressure and urine production</td>
<td>• Some students thought an increased ADH level would cause increased production of urine.</td>
</tr>
<tr>
<td>• Interpreting blood-glucose data presented in tables and graphs</td>
<td></td>
<td>• Some students thought that increased aldosterone would lead to decreased blood pressure.</td>
</tr>
<tr>
<td>• Understanding the effect of insulin on blood-glucose level and how diabetes mellitus affects blood-glucose level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Demonstrating understanding that type 2 diabetes mellitus results from reduced sensitivity of cells to insulin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Unit B: Reproduction and Development

<table>
<thead>
<tr>
<th>Areas of Strength</th>
<th>Areas of Difficulty</th>
<th>Most Common Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interpreting diagrams of human reproductive systems to identify structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Describing the functions of structures in the human reproductive systems</td>
<td>• Differentiating interstitial and Sertoli cells in a diagram of a cross section of a testis</td>
<td>• Some students confused the functions of seminiferous tubules with those of the epididymides when the structures were shown on a diagram but not named.</td>
</tr>
<tr>
<td></td>
<td>• Differentiating the roles of interstitial and Sertoli cells in reproduction</td>
<td></td>
</tr>
<tr>
<td>• Interpreting a description of an experiment relating to the role of the Y chromosome in sex determination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Identifying the roles of FSH and LH in human reproduction</td>
<td>• Predicting how administration of hormones in an experimental or therapeutic context affects negative feedback control of GnRH, LH, and FSH</td>
<td>• Some students confused the functions of pituitary hormones with ovarian hormones.</td>
</tr>
<tr>
<td>• Understanding the relationship between LH, testosterone, and spermatogenesis</td>
<td>• Interpreting a context to predict how an external factor alters the secretion of hormones throughout the menstrual cycle</td>
<td></td>
</tr>
<tr>
<td>• Applying understanding of the relationship between LH, testosterone, and spermatogenesis to a new context</td>
<td></td>
<td>• Some students did not recognize the inhibition of FSH secretion and the development of breast tissue as effects of high estrogen levels.</td>
</tr>
<tr>
<td>• Understanding the regulation of testosterone through negative feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>• Relating the timing of germ-layer formation with the first trimester of pregnancy</td>
<td>• Describing the role of hCG and the corpus luteum during the first trimester of pregnancy</td>
<td>• Some students confused the zygote for the blastocyst and vice versa in diagrams and in descriptions.</td>
</tr>
<tr>
<td></td>
<td>• Identifying the germ layers from which various structures arise during development</td>
<td>• Some students were not able to identify the blastocyst from a description.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some students identified the chorion as a component of the umbilical cord.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some students thought the allantois contributes to the development of the placenta, and others thought the amnion does.</td>
</tr>
<tr>
<td>• Interpreting a context related to an STI to determine effects on reproduction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Unit C: Cell Division, Genetics, and Molecular Biology

<table>
<thead>
<tr>
<th>Areas of Strength</th>
<th>Areas of Difficulty</th>
<th>Most Common Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Understanding that mitosis produces cells that are identical to the parent cell</td>
<td>• Interpreting micrographs to determine whether mitosis or meiosis is taking place, taking into consideration the type of tissue involved and the purposes of mitosis and meiosis</td>
<td>• Some students thought that DNA replication occurs during prophase and cytokinesis occurs during interphase.</td>
</tr>
<tr>
<td>• Interpreting micrographs to determine the phase of mitosis occurring in the cell</td>
<td>• Interpreting diagrams of cells in various stages of meiosis to determine the cell that began meiosis at a given ploidy</td>
<td>• Some students thought all gametes are haploid, whether produced by mitosis or meiosis.</td>
</tr>
<tr>
<td>• Justifying why an uneven number of chromosomes is incompatible with meiosis</td>
<td>• Understanding whether sister chromatids or homologous chromosomes would be involved in a given type of cell division</td>
<td>• Some students thought that meiosis results in haploid cells that are identical to the parent plant.</td>
</tr>
<tr>
<td></td>
<td>• Understanding whether chromosomes would appear to be duplicated or unduplicated at various phases of mitosis and meiosis, as well as the implications for ploidy</td>
<td>• Some students thought that recombination of genes is typical for mitosis.</td>
</tr>
<tr>
<td></td>
<td>• Evaluating diagrams of mitosis or meiosis for correctness and justifying why</td>
<td>• Some students thought mitosis was shown correctly as long as one cell was shown producing two daughter cells, regardless of the chromosome arrangement in those daughter cells.</td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>-------------------</td>
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<td>--------------------</td>
</tr>
<tr>
<td>• Interpreting karyotypes to determine ploidy and genotypic sex of cells</td>
<td>• Interpreting results of a genetic cross to determine which one of Mendel’s laws or principles is exemplified</td>
<td>• Some students weren’t sure how to interpret the presence of two X chromosomes and one Y chromosome in a karyotype.</td>
</tr>
<tr>
<td>• Interpreting life cycles to determine when meiosis, fertilization, and mitosis take place</td>
<td>• Selecting a pedigree from among four that illustrates a described pattern of inheritance</td>
<td>• Some students mistook mitosis and meiosis for one another in life cycles.</td>
</tr>
<tr>
<td>• Determining a pattern of inheritance from a description</td>
<td>• Knowing when to apply the product rule</td>
<td>• Some students thought two individuals who are homozygous recessive for a trait can produce unaffected offspring.</td>
</tr>
<tr>
<td>• Interpreting pedigrees with a stated inheritance pattern to determine the genotypes of individuals</td>
<td>• Interpreting a description of a reproductive technology that would prevent transmission of an inherited condition</td>
<td>• Some students apply the rule when they shouldn’t for sex-linked traits, and some don’t apply it when they should for autosomal traits.</td>
</tr>
<tr>
<td>• Working with many different contexts and symbols to solve simple and complex genetics problems</td>
<td>• Calculating probabilities and ratios for autosomal dominant and recessive inheritance, codominant traits, and incomplete dominance</td>
<td></td>
</tr>
<tr>
<td>• Calculating probabilities and ratios for autosomal dominant and recessive inheritance, codominant traits, and incomplete dominance</td>
<td>• Performing dihybrid crosses involving a combination of autosomal and sex-linked alleles, including those involving gene interaction</td>
<td></td>
</tr>
<tr>
<td>• Performing dihybrid crosses involving a combination of autosomal and sex-linked alleles, including those involving gene interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>• Determining parental genotypes and phenotypes for various patterns of inheritance, including multiple alleles</td>
<td></td>
<td>• Some students thought factors other than the position of a gene on a chromosome determine whether or not genes are inherited together.</td>
</tr>
<tr>
<td>• Determining the order of dominance of multiple alleles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Interpreting chromosome maps to determine the arrangements of genes on a chromosome</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>• Understanding the structure of DNA, including nitrogenous base pairing</td>
<td>• Determining the sequence in which some events in protein synthesis would occur</td>
<td>• Some students mistook the bonds between nitrogenous bases in the centre of a DNA molecule for the sugar–phosphate bonds in the backbone.</td>
</tr>
<tr>
<td>• Understanding the semi-conservative nature of DNA replication</td>
<td>• Determining a gene sequence from an amino acid sequence</td>
<td>• Some students thought that transcription occurs after mRNA moves into the cytoplasm.</td>
</tr>
<tr>
<td></td>
<td>• Determining an amino acid sequence from a gene sequence</td>
<td>• Some students thought that amino acids are transported by mRNA rather than tRNA.</td>
</tr>
<tr>
<td></td>
<td>• Determining the change in the amino acid coded by a mutated gene sequence</td>
<td>• Some students identified mRNA codons that code for an amino acid sequence rather than DNA triplets when asked for the gene sequence.</td>
</tr>
<tr>
<td></td>
<td>• Determining a mutation in a gene sequence that would lead to the incorporation of a stop codon in the corresponding mRNA sequence</td>
<td></td>
</tr>
</tbody>
</table>

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### Unit D: Population and Community Dynamics

<table>
<thead>
<tr>
<th>Areas of Strength</th>
<th>Areas of Difficulty</th>
<th>Most Common Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interpreting a description of an experiment to identify the variables, especially the responding variable</td>
<td></td>
<td>• Some students mistook one of the controlled variables in an experiment for the manipulated variable; others mistook the manipulated variable for one of the controlled variables.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some students classified two variables as manipulated variables.</td>
</tr>
<tr>
<td>• Identifying factors that contribute to changes in the gene pool, especially natural selection, mutations, and the bottleneck and founder effects</td>
<td></td>
<td>• Determining the parts of the Hardy–Weinberg expression that represent certain genotypes or phenotypes</td>
</tr>
<tr>
<td>• Predicting actions that could increase genetic diversity</td>
<td></td>
<td>• Some students did not take the square root when calculating $q$.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some students calculated $q$ instead of $2pq$.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some students represented the proportion of a population with the dominant phenotype as $p^2$ rather than $p^2 + 2pq$.</td>
</tr>
<tr>
<td>• Calculating the frequency of the recessive allele in a population when given the number of people affected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Calculating the frequency of the heterozygous genotype when given the number of people affected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Areas of Strength</td>
<td>Areas of Difficulty</td>
<td>Most Common Errors</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>• Interpreting contexts to classify symbiotic relationships and types of competition between organisms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Calculating growth rate</td>
<td>• Calculating growth rate from data presented in a graph</td>
<td>• Some students selected incorrect data from the graph to use in the growth-rate calculation.</td>
</tr>
<tr>
<td></td>
<td>• Calculating per capita growth rate</td>
<td>• Some students thought that to calculate cgr, they should divide by the final population rather than the initial population.</td>
</tr>
<tr>
<td>• Calculating population density</td>
<td></td>
<td>• When calculating cgr, some students did not perform ( \Delta N ) before dividing.</td>
</tr>
<tr>
<td>• Interpreting contexts to identify reproductive strategies and growth patterns</td>
<td>• Applying the ideas of carrying capacity and environmental resistance to a new context</td>
<td>• Some students confused the ideas of environmental resistance and carrying capacity.</td>
</tr>
<tr>
<td></td>
<td>• Integrating the concepts of carrying capacity and mortality rate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Using population data presented in a table to predict the shape of a growth curve</td>
<td></td>
</tr>
</tbody>
</table>
Clarifications

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.

• Some teachers have asked if students should be learning about aldosterone specifically as a stress hormone. For the purpose of Biology 30, students are required to study only epinephrine and cortisol as hormones that relate specifically to stress. Outcome A2.2k specifies, in part, that students should be able to describe the relationship between ACTH and cortisol in addition to how they together maintain homeostasis through feedback. The relationship between ACTH and aldosterone is not present in the prescribed outcomes, and aldosterone secretion is controlled mainly by the renin-angiotensin system, which is beyond the scope of Biology 30. Students are still required to describe the function of aldosterone and explain its metabolic role in maintaining homeostasis, as outlined in A2.2k, A2.3k, A2.4k, and A2.6k.

• Although the umbilical cord is not explicitly listed in outcome B3.1k, its inclusion is implied. The umbilical cord is very closely associated with both the allantois and the placenta, and a discussion of the development of those two extra-embryonic membranes wouldn’t be complete without it.

• In many cell types, the division of cytoplasm by cytokinesis typically occurs in conjunction with mitosis, ending in telophase. In some cell types, cytokinesis occurs after the completion of mitosis, but before the next interphase begins. Students should be aware that cytokinesis does not occur during interphase.

• Some teachers have expressed concerns about whether artwork and diagrams with colour can be interpreted by students who have colour-blindness. The graphic artists who produce the images use colour-blindness filters to ensure that students with colour-blindness are able to interpret the images. In addition, some of the people who are involved in the diploma-exam development and review processes have colour-blindness, which is of great assistance in judging whether or not students would reasonably be able to interpret the images used. Students and teachers who find artwork difficult to interpret for any reason are encouraged to provide feedback.

For a full listing of all the clarifications that have appeared over the last number of years, please see the archived bulletin.
Student-based Performance Standards

A document that describes standards of achievement appropriate to the Biology 30 Program of Studies was updated in 2018 and can be found at Writing diploma exams. The student-based performance 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. The Student-based Performance Standards document is posted on the Alberta Education website.

Released Items

The most recent version of Released Items was published in fall 2019 and consisted of items from the November 2018 Diploma Examination.

Biology 30 practice tests are available on Quest A+. The year-end practice test, 2007 Released Items, 2009 Released Items, 2011 field-tested items, and 2014 Released Items include a formative element. Students can view feedback on correct and incorrect answers. They can also view the cognitive level that corresponds to a particular question.
Biology 30 Data Pages

Biology tear-out data pages are included at the back of the diploma examination booklet. Biology 30 data pages are available at Writing diploma exams.

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

Using Calculators

The Biology 30 Diploma Examination requires the use of a calculator that does not have prohibited properties or a graphing calculator approved by Alberta Education. The calculator rules, list of prohibited properties, criteria, and keystrokes for clearing approved graphing calculators are found on the Alberta Education website.

Teachers should be aware of the capabilities of approved graphing calculators that are available when the calculator is not configured for exam purposes, as these capabilities may impact classroom instruction and assessment. These capabilities may also be applicable to other high school math and science courses.
Publications and Supporting Documents

The following documents are published by Alberta Education:

*Biology 30 Information Bulletin* Updated version available by August prior to the beginning of each school year

*Biology 30 Archived Bulletin* Updated version available by August prior to the beginning of each school year

*Biology 30 Student-based Performance Standards* Updated in fall 2018

*Biology 30 Released Materials* Most recent version published in fall 2019, which consists of items from the *November 2018 Diploma Examination*

*Biology 30 Exemplars* Updated in fall 2016

*Examples of Descriptions Used in Audio Versions of Science Diploma Exams* Published in 2020
Website Links

Alberta Education website

Programs of Study

General Information Bulletin
contains specific directives, guidelines, and procedures of diploma examinations

Diploma Examinations Program

Writing Diploma Examinations
contains Guides for Students, exemplars, and other support documents

Quest A+
contains practice questions and questions from previous diploma examinations

Field Test Request System

Field-test Information

School Reports and Instructional Group Reports
contain detailed statistical information on provincial, group, and individual student performance on the entire examination
How to Get Involved

High-quality diploma examinations are the product of close collaboration between classroom teachers and Alberta Education. Classroom teachers from across Alberta are involved in many aspects of diploma examination development, including the development of items; the building, reviewing, administering, and marking of field tests; the reviewing and validating of diploma examinations; and the marking 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. All items on Biology 30 Diploma Examinations are written by Biology 30 teachers from across Alberta. After the first year of provincial implementation of the program of studies, items are field tested to ensure their reliability and validity. Diploma examinations are reviewed by editors; a technical advisory working group composed of science experts from post-secondary institutions, teachers, and curriculum staff; translators; and a French validation working group.

Alberta Education values the involvement of the teachers and annually asks school jurisdictions for the names of teachers who are interested in being involved in any of the development processes for diploma examinations. Teachers who are interested in developing items, constructing field tests, or reviewing and validating 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 each fall, teachers are welcome to have their names submitted at any time.

Periodically, we send out information to those Biology 30 teachers who are on our contact list. If you are not on that list and would like to receive updates related to Biology 30 assessment activities, please contact either Shannon Mitchell, Biology 30 Exam Manager, at Shannon.Mitchell@gov.ab.ca or Claudine Coleman, Biology 30 Examiner, at Claudine.Coleman@gov.ab.ca.
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Inquiries about special cases, diploma examination 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
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