

Information  
Bulletin

Biology

30

2011 – 2012 Diploma Examinations Program

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Freedom To Create. Spirit To Achieve.

This document was written primarily for:

Students	✓
Teachers	✓ of Biology 30
Administrators	✓
Parents	
General Audience	
Others	

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You can find [diploma examination-related materials](#) on the Alberta Education website at [education.alberta.ca](http://education.alberta.ca).

At the home page, click on the link *Administrators*; then click on the link *Provincial Testing*. Next click on *Diploma Examinations* and then one of the specific links listed under the *Diploma Examinations* heading.

## ***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.

Students of Biology 30 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 Biology 30 Diploma Examination will continue to contain embedded anchor items in order to maintain consistent standards over time. Because the changes in the Program of Studies were minimal and the percentage emphasis of the units of Biology 30 did not change, diploma examinations have continued equating since the implementation of the revised Program of Studies. The revised Program of Studies is available online at [education.alberta.ca](http://education.alberta.ca) via the pathway Teachers > (Programs of Study) Science > Programs of Study > Biology 20–30, 2007.

***NEW*** Alberta Education receives questions and feedback from teachers and students by email, by phone, and as comments on field tests. In response to the questions and feedback received, the following points clarify and specify the use of some vocabulary in the Biology 30 diploma examination.

- In Unit B, outcome B1.1k, the term *Fallopian tube* is used on page 62 of the program of studies, and therefore will be used on the examination rather than alternative terms such as *oviduct* or *uterine tube*.
- The terms *haploidy*, *diploidy*, and *polyploidy* appear on page 70 of the program of studies in Unit C, outcome C1.1k; therefore, students should be familiar with these terms as well as the more general term *ploidy*. The terms *triploid* and *tetraploid* will be defined in a context if they are used on an examination.

- Students in Biology 30 are not required to differentiate between the terms *secondary oocyte* and *ovum*. Therefore the term *ovum* will be used on diploma examinations to refer to the secondary oocyte. If the term *secondary oocyte* appears on an examination, it will be defined in a context. In certain circumstances, the word *egg* is used as an alternative to *ovum*.
- In general, students should expect to express their answers to questions that ask for a calculated probability as a decimal rather than as a percentage. Occasionally, an answer expressed as a percentage will be required, but only if necessary. For example, if the answer to a numerical-response question expressed as a probability were 0.005 23, students would not be able to properly indicate the answer in the four boxes in the numerical-response section of the answer sheet. Instead, students would be asked for the percentage probability, making the answer 0.52%, which easily fits into the four boxes. In such cases, the question will clearly direct students to express their answer as a *percentage probability*. For all numerical-response questions, students are encouraged to carefully read the instructions for expressing answers that follow each question.

The following points were introduced in the 2010 – 2011 subject bulletin to provide clarification for some outcomes.

- In the Biology 30 Program of Studies, in the approved textbooks, and on the Biology 30 diploma examinations, the terms *sex linked* and *X linked* have been used interchangeably to describe a pattern of inheritance. Although sex-linked inheritance most often refers to genes inherited on the X chromosome, the term can also refer to genes inherited on the Y chromosome. Therefore, to improve clarity, the terms *X linked* and *Y linked* will be used to describe patterns of inheritance on diploma examinations instead of the term *sex linked*.
- In the Biology 30 Program of Studies, the concept of open and closed populations appears in outcome D3.3k (page 84). However, this portion of the D3.3k outcome is not present in the McGraw–Hill Ryerson textbook, *Inquiry into Biology*. Teachers should be aware that open and closed populations constitute part of the required program of studies; therefore, teachers should take steps to ensure they include these concepts in their teaching of the course.

## ***Performance Expectations***

### **Performance 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 apprise Biology 30 teachers of 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 designing, 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 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. Through their understanding of some key biological concepts and technologies, these students can interpret short reports of current biological issues. They identify scientific, technological, and societal components of biological problems.

## **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 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 environmental and ethical issues in the field of science and technology.

## ***Assessment Standards***

A document that describes [standards of achievement](#) appropriate to the Biology 30 program of studies can be found on the Alberta Education website in the archived section of the Biology 30 Information Bulletin. The assessment standards document was developed by teachers from across Alberta in co-operation with the Assessment Sector, Alberta Education. It is not intended to replace the program of studies.

## ***Assessment Exemplars***

A document of [Biology 30 assessment exemplars](#) has been developed to assist teachers with the interpretation of curricular outcomes in the revised program of studies implemented in September 2008. The assessment exemplars, which include multiple-choice and numerical-response questions, can be found on the Alberta Education website in the same section as the Biology 30 Information Bulletin.

## ***NEW Standards Confirmation***

In February 2011, 20 teachers representing most school divisions across the province participated in an intensive, two-day standards confirmation working group. The purpose of the session was to evaluate the appropriateness of current assessment standards (acceptable standard, standard of excellence) in Biology 30, which were determined in January 2006 with the first baseline examination.

Teachers who participated in the work session used both the Modified Angoff and Bookmark methods, which are two of the most commonly used and relied-upon methods of confirming standards, as described in *Setting Performance Standards: Concepts, Methods, and Perspectives* (Gregory J. Cizek, ed.). Teacher participants used the two methods to analyze the January 2010 and January 2011 Biology 30 diploma examinations with the ultimate goal of determining whether the assessment standards should be raised, be lowered, or remain the same.

Quantitative and qualitative analyses conducted during the process revealed that the performance standards determined by the teacher participants are consistent with those established on the baseline examination in January 2006. Therefore, the standards set by the baseline examination in January 2006 remain appropriate for students currently in Biology 30.

# *Examination Specifications and Design*

Each Biology 30 Diploma Examination is designed to reflect the general outcomes outlined in the Biology 30 Program of Studies. 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.

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

Most of the examination questions are context-based, meaning they are organized into sets that are related to contexts associated with topics in the program of studies. A set of questions can assess a student's ability to integrate several Biology 30 outcomes. 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. Students should expect to be assessed on skills and STS outcomes on their Biology 30 Diploma Examination.

The design of the 2011–2012 Biology 30 Diploma Examinations is as follows:

<i>Question Format</i>	<i>Number of Questions</i>	<i>Percentage Emphasis</i>
Multiple Choice	48	80
Numerical Response	12	20

Some questions may be grouped together in sets that relate to specific contexts. A particular context may be used for one or more multiple-choice question(s); one or more numerical-response question(s); or a combination of multiple-choice and numerical-response questions.

Answers for multiple-choice questions are recorded in the first section of the machine-scored answer sheet. Answers for numerical-response questions are recorded in the second section of the machine-scored answer sheet, on the same side of the sheet as answers for multiple-choice 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 the question cannot be properly addressed without the context having been read. Students are advised to read contexts carefully.

**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 instruction 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. Some further points of clarification are provided below:

***NEW***

- In some cases, a number given in a diagram or with a description can be used more than once in the answer; in such cases, a statement will be added to the end of the question indicating to students that a number can be used more than once.
- Some numerical-response questions could have more than one correct answer. In such cases, a statement will be added to the end of the question indicating to students that there is more than one correct answer to the question.
- In the past, students have been directed to arrange their selected responses in lowest-to-highest numerical order for selection-type numerical-response questions. To create consistency in numerical-response instructions among

science subjects, students will now be directed to arrange their selected response in any order. In other words, rather than being given the instruction to “record...your answer **in lowest-to-highest numerical order** in the numerical-response section of the answer sheet,” students will be given the instruction to “record...your answer **in any order** in the numerical-response section of the answer sheet.” This change will be reflected on examinations beginning in the 2011–2012 school year.

- Note that the answer for any one numerical-response question will not necessarily require the use of all four columns in the grid provided on the answer sheet. Some answers could require three columns, and some answers could require two columns.

## ***NEW Format Changes***

The formatting of content in some examination booklets has changed slightly. The instructions pages now begin on the inside front cover, and the side, top, and bottom page margins are narrower than before. **The changes are not a misprint.** As a result of these changes, the total amount of paper used each year in printing the examinations will decrease by several tonnes.

Beginning in the 2011–2012 school year, the font size in the context boxes in Biology 30 Diploma Examinations will be changed to 12 point from 10 point. The change was made in order to maintain consistency in formatting with diploma examinations in other subjects and in response to requests by teachers and students. The questions on the examination have always been in 12-point font and will retain this format.

## ***NEW Assessment of STS Outcomes***

Examination questions measure students’ understanding of biological concepts. 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, although the assumption is made that teachers are carrying out assessments and observations of STS outcomes with their students throughout the course. However, the appearance of questions on the diploma examination that assess STS outcomes should be expected, because the Biology 30 Program of Studies includes 10 different STS outcomes.

Each of the STS outcomes present in the Biology 30 Program of Studies is listed below. Teachers should be aware that not every STS outcome appears in every unit. The list below includes the specific unit or units in which the STS outcome appears.

**Students will:**

- explain that scientific knowledge and theories develop through hypotheses, the collection of evidence, and the ability to provide explanations
  - A1 (Nervous system)
- explain that scientific investigation includes the processes of analyzing evidence and providing explanations based upon scientific theories and concepts
  - A1 (Nervous system)
- explain that the goal of technology is to provide solutions to practical problems
  - A1 (Nervous system)
- explain that science and technology are developed to meet societal needs and expand human capability
  - A2 (Endocrine system), B3 (Development), C1 (Cell division)
- explain that science and technology have both intended and unintended consequences for humans and the environment
  - A2 (Endocrine system), C3 (Molecular biology), D1 (Gene-pool change)
- explain that decisions regarding the application of scientific and technological development involve a variety of perspectives, including social, cultural, environmental, ethical, and economic considerations
  - B1 (Reproductive structures), B2 (Reproductive hormones), B3 (Development), C2 (Mendelian genetics)
- explain how science and technology have influenced and been influenced by historical development and societal needs
  - B2 (Reproductive hormones)
- explain that scientific research and technological development help achieve a sustainable society, economy, and environment
  - C3 (Molecular biology)
- explain how concepts, models, and theories are often used in interpreting and explaining observations and in predicting future observations
  - D1 (Gene-pool change), D3 (Growth)
- explain why Canadian society supports scientific research and technological development to facilitate a sustainable society, economy, and environment
  - D2 (Relationships)

## **NEW** *Assessment of Skills Outcomes*

Examination questions measure students' understanding of biological concepts. 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, although the assumption is made that teachers are carrying out assessments and observations of skills outcomes with their students throughout the course. Each of the four skills listed below appears in every unit in the Biology 30 Program of Studies. Therefore, the appearance of questions on the diploma examination that assess these skills should be expected.

Examples taken from the skills portion of the Program of Studies are provided below for some units.

### **Students will:**

- formulate questions about observed relationships and plan investigations into questions, ideas, problems, and issues

#### *Examples:*

- design an experiment to investigate heat, cold, pressure, and touch receptors (**A1.1s**, page 57)
- formulate a hypothesis, from published data, on an environmental factor that can be detected and responded to by humans (**B2.1s**, page 59)
- 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

#### *Examples:*

- use a microscope and prepared slides to observe neurons and synapses (**A1.2s**, page 57)
- use a microscope to observe prepared slides of ovaries and testes so as to distinguish eggs and sperm from their supporting structures; i.e., follicle, corpus luteum, interstitial cells, Sertoli cells, seminiferous tubules (**B1.2s**, page 63)
- use a microscope and prepared slides of onion root tip cells to identify the stages of a cell cycle and calculate the duration of each stage (**C1.2s**, page 71)
- analyze data and apply mathematical and conceptual models to develop and assess possible solutions

#### *Examples:*

- interpret hormonal data from published investigations (**B3.3s**, page 67)
- prepare and interpret models of human karyotypes by using hard-copy or online resources (**C1.3s**, page 71)
- draw and interpret pedigree charts from data on human single-allele and multiple-allele inheritance patterns (**C2.3s**, page 75)
- apply the skills and conventions of science in communicating information and ideas in assessing results

#### *Example:*

- use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results (**A1.4s**, page 57)

## *NEW Sample Question Formats*

This section contains examples of question formats that teachers and students might not yet be familiar with. Teachers and students should expect to see these types of questions on upcoming field tests and diploma examinations.

- *Assessment of STS outcomes*

Spider silk is five times stronger than traditional steel. It can be used in a variety of applications, such as artificial ligaments and bullet-proof vests. Gene mapping has been used to identify the gene that codes for the production of spider silk. Once identified, this gene can be inserted into the DNA of bacteria to give bacteria the ability to produce spider silk. Gene therapy is a procedure during which a gene of interest is inserted into the DNA of another organism for a therapeutic purpose.

The use of spider silk to repair defects in the human body is an example of an

- A. intended consequence of using gene therapy
- B. intended consequence of using gene mapping
- C. unintended consequence of using gene therapy
- D. unintended consequence of using gene mapping

Answer: **A**

Outcome C3.1sts

---

Pre-implantation genetic diagnosis (PGD) is a procedure used to test one or two cells from an embryo for genetic disorders. PGD is done after in vitro fertilization but before implantation.

A possible benefit to society of PGD is that

- A. infertile men are able to father a child
- B. parents have the ability to select traits in their offspring
- C. governments spend less money on treating genetic disorders
- D. women who are no longer fertile might be able to conceive a child

Answer: **C**

Outcome B3.1sts and B3.2sts

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 societies.

**Numerical Response**

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

**Statement:** \_\_\_\_\_  
**Consideration:**    **Societal**            **Technical**            **Economic**            **Ecological**

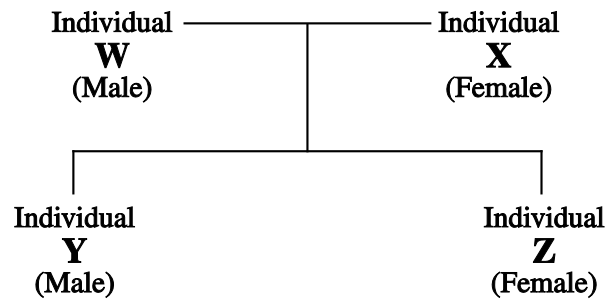
(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

Answer: **4312**  
Outcome B2.2sts

- *Assessment of skills outcomes*

Fatal familial insomnia is a genetic disorder characterized by the degeneration of a region of the brain that controls sleep. The average age of onset of the disorder is 49 years. Fatal familial insomnia is caused by the presence of an autosomal dominant mutation.

**A Hypothetical Pedigree Chart**



**Some Pedigree Symbols**



**Numerical Response**

Using the pedigree symbols numbered above, fill in the hypothetical pedigree chart in a manner that illustrates the pattern of inheritance for fatal familial insomnia.

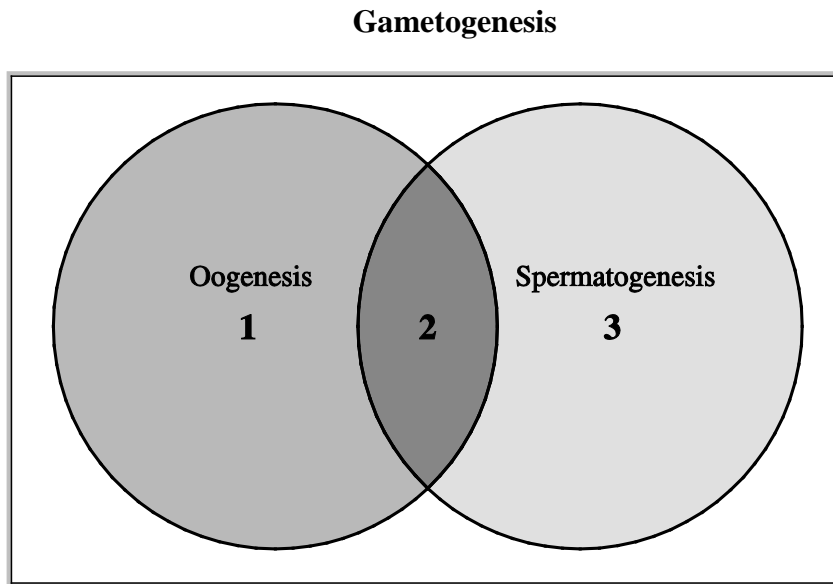
**Symbol Number:** \_\_\_\_\_  
**Individual:**            **W**            **X**            **Y**            **Z**

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

Answers: **2143, 2341, 4123**  
 Outcome C2.3s

- *Assessment of skills outcomes*

A Venn diagram uses two or more circles to represent different concepts. Overlapping areas of circles show the aspects in common to both concepts (area 2). The differences between the two concepts are shown in areas 1 or 3. The Venn diagram below shows the relationship between oogenesis and spermatogenesis.



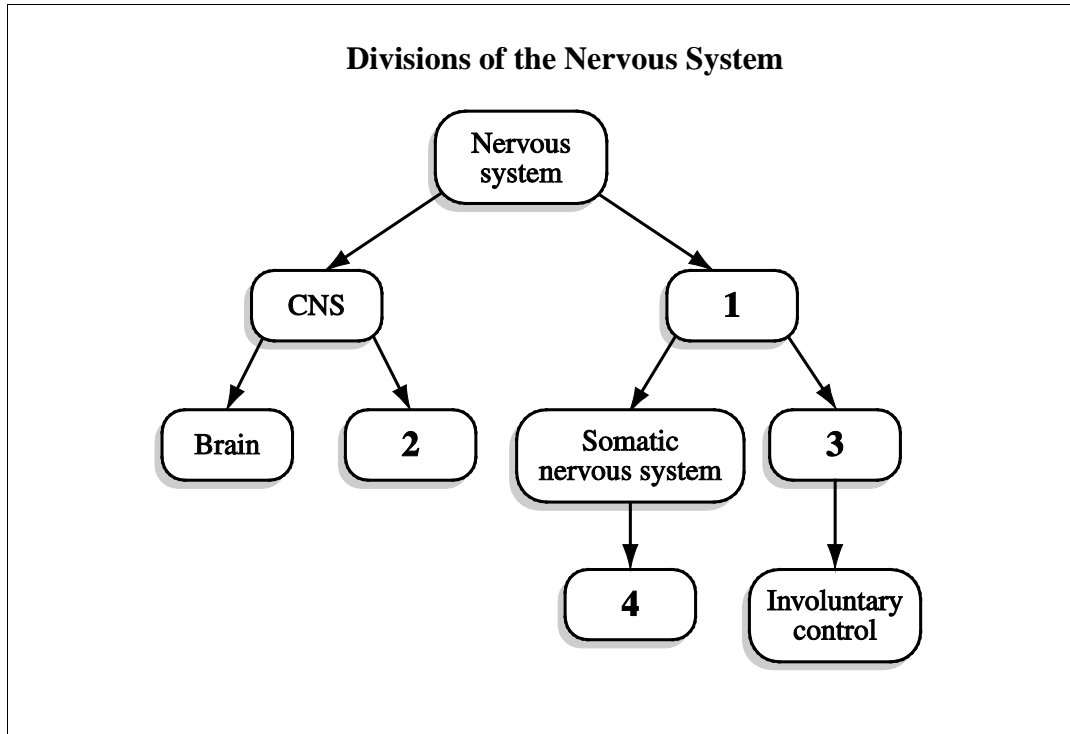
### **Numerical Response**

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

<b>Number:</b>	_____	_____	_____	_____
<b>Description:</b>	<b>Four daughter cells produced</b>	<b>Unequal cytoplasmic division</b>	<b>Stimulated by FSH</b>	<b>Daughter cells equal in size</b>

Answer: **2123**  
Outcome C1.3k

- *Concept map diagram*



**Numerical Response**

Match the number in the diagram of the divisions of the nervous system with its description below.

Number: \_\_\_\_\_  
 Description: PNS                      Voluntary control                      Spinal cord                      Autonomic nervous system

Answer: **1423**  
 Outcome A1.2k

## ***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 composed of scientific experts from Alberta universities, a teacher validation committee, translators, 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 should ask their principals to submit their names through their district office to the Assessment Sector's committee list. Although the call for submissions occurs in early September, teachers are welcome to have their names submitted at any time.

### ***NEW Field Testing***

Biology 30 field tests that will be administered in the 2011–2012 school year will require either 50 minutes or 65 minutes of writing time. Therefore, the total administration time of a Biology 30 field test will be either 60 minutes or 75 minutes, respectively. 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 will be offered in paper-and-pencil format as well as in digital format.

In addition, Unit B (Reproduction and Development) and Unit D (Population and Community Dynamics) field tests will be offered for the first time in the 2011–2012 school year. Units B and D were chosen because they are typically taught near the end of the course; teachers have indicated that their students are sometimes scheduled to write field tests before they have finished the course. It is hoped that the availability of unit field tests will allow teachers and students to finish the course before students write questions on unit field tests. To that end, unit field tests will be offered only in digital format, through Alberta Education's Quest A+ website, which allows teachers to have some flexibility in choosing the date of field testing. Units B and D might not be taught near the end of the course in every classroom. Given that teachers approach the Biology 30 course in a number of different ways, they are welcome to schedule unit field tests to suit their programming.

For more information on requesting field tests, please refer to the *Field Testing* section of the [General Information Bulletin](#) at education.alberta.ca via the pathway Teachers > (Additional Programs and Services) Diploma Exams > Diploma General Information Bulletin. General dates to be aware of include the following:

September 2011 Registration for field tests to be administered in December 2011 and January 2012

February 2012 Registration for field tests to be administered in June 2012

## ***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 will be allowed access to a 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 at education.alberta.ca via the pathway Teachers > (Additional Programs and Services) Diploma Exams > Diploma 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, which set 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.

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. For more information about equating, please refer to the [Alberta Education](#) website at education.alberta.ca, then follow the pathway Teachers > (Additional Programs and Services) Diploma Exams > Initiative to Maintain Consistent Standards on Diploma Examinations.

## ***Publications and Supporting Documents***

The following documents are published by Alberta Education:

- [\*Information Bulletin\*](#), updated version available by August prior to each school year at education.alberta.ca via the pathway Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins > Biology 30
- [\*Assessment Highlights\*](#), provides information on students' strengths, weaknesses, and trends in performance on 2011 diploma examinations. An updated version is available in early autumn at education.alberta.ca via the pathway Teachers > (Additional Programs and Services) Diploma Exams > Assessment Highlights > Biology 30
- [\*Diploma Examination Detailed Reports\*](#), available on the Alberta Education Extranet

## ***Biology Tear-Out Data Pages***

Biology tear-out data pages are included at the back of the diploma examination booklet. These data pages are available at education.alberta.ca via the pathway Teachers > (Additional Programs and Services) Diploma Exams > (Data Booklets) Biology 30.

**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 at education.alberta.ca via the pathway Teachers > (Additional Programs and Services) Diploma Exams > Diploma General Information Bulletin > Using Calculators & Computers.

## *Preparation Materials for Students*

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

[\*\*A Guide for Students – Biology 30\*\*](#) This document is available at [education.alberta.ca](http://education.alberta.ca) via the pathway [Students > Preparing for Diploma Exams > Diploma Guides for Students > Biology 30](#).

[\*\*Assessment Exemplars – Biology 30\*\*](#) This document is available at [education.alberta.ca](http://education.alberta.ca) via the pathway [Teachers > \(Additional Programs and Services\) Diploma Exams > Information Bulletins > Biology 30 Exemplars](#).

[\*\*Assessment Standards – Biology 30\*\*](#) This document is available at [education.alberta.ca](http://education.alberta.ca) via the pathway [Teachers > \(Additional Programs and Services\) Diploma Exams > Information Bulletins > Biology 30 Archived](#).

[\*\*Online Practice Tests – Biology 30\*\*](#) These tests are available at <https://questaplus.alberta.ca> via the pathway [Practice Tests > Grade 12 > Biology 30](#). In early autumn 2011, Quest A+ will have previously field tested items available. The year-end practice test, 2009 released items, and 2011 field-tested items available on Quest A+ now include a formative element. Students can click on a button to view information explaining why an alternative is correct or incorrect.

## *Written-Response Question for Classroom Assessment*

Teachers are encouraged to use a variety of methods to assess the learning of their students. Outcomes prescribed in the Biology 30 Program of Studies include knowledge, skills, and attitudes. Some of these outcomes can be more effectively assessed through the use of classroom and laboratory activities, observations, assignments, experiments, and quizzes than by machine-scored tests.

A sample written-response question illustrating one method of assessment that teachers could use with their students is included on the following pages. This question appeared on a field test in January 2009. After marking and data analysis, this written-response item was deemed to be more difficult than desired. Teachers are welcome to make whatever modifications to the question they deem appropriate before using it with their students.

## January 2009 Biology 30 Field Test Open-Response Question, Sample Responses, and Scoring Guide

Use the following information to answer the first question.

Complete androgen insensitivity syndrome (CAIS) is a rare, sex-linked recessive disorder in which babies born with male sex chromosomes develop as females.

Although people with CAIS have a normal Y chromosome, a mutation on their X chromosome results in the production of a defective testosterone receptor, making cells insensitive to testosterone. As a result, people with CAIS develop breasts and a vagina, but they develop testes in their abdomens rather than ovaries. Although people with CAIS are infertile, the disorder has remained in the population.

For many years, female athletes who compete in the Olympics have been tested to verify their sex. A male sprinter competed as a female in a women's event in the 1932 Olympics; it was not discovered until many years later that the athlete was male. Some people think that testing for sex is unfair and that these tests should be discontinued, whereas others think that this testing is necessary to ensure fair competition. The issue of female sex verification continues to challenge the International Olympic Committee.

—based on Ferguson-Smith, M.A., and Elizabeth A. Ferris. 1991. Gender verification in sport: The need for change? *British Journal of Sports* 25 (1): 17-20.

### Written Response—15 marks

1. Write a unified response addressing the points identified below.

### Sample Answers

- **Describe** two reasons why a person with CAIS is infertile.

#### **Female:**

*A person with CAIS does not have ovaries and therefore cannot produce ova. A person with CAIS does not have oviducts to allow the transport of ova to the uterus or to allow sperm to fertilize an ovum.*

*A person with CAIS does not have a uterus to allow for the nourishment of the embryo.*

**or**

*Any other reasonable answer*

#### **Male:**

*A person with CAIS does not have functioning testes because they are located in the abdomen, which has a higher temperature than that required for normal spermatogenesis.*

*A person with CAIS does not have vasa deferentia, which prevents sperm from travelling from the testes to the exterior of the body.*

**or**

*Any other reasonable answer*

**Explain** how the administration of FSH could increase fertility in a person without CAIS but will not increase fertility in a person with CAIS.

*In a man without CAIS, FSH will increase spermatogenesis. FSH will not increase fertility in a person with CAIS because the temperature in the abdomen is too high for effective spermatogenesis.*

*In a man without CAIS, FSH will increase spermatogenesis. FSH will not increase fertility in a person with CAIS because there is no pathway for the sperm to be released from the body.*

*In a woman without CAIS, FSH will stimulate the development of a follicle in an ovary. FSH will not increase the fertility of a person with CAIS because that person does not have ovaries.*

**or**

*Any other reasonable answer*

- **Explain** how CAIS can be inherited from two unaffected parents.

*The parents are unaffected because the father carries a normal X chromosome and a normal Y chromosome, whereas the mother carries one normal X chromosome and one X chromosome with the CAIS mutation, which is recessive. If a sperm carrying a Y chromosome fertilizes an ovum carrying an X chromosome that carries the mutation associated with CAIS, then a person will inherit CAIS.*

**Explain** two ways in which the inheritance of CAIS differs from the inheritance of an autosomal genetic disorder.

- *Only people who are genetically male will have CAIS, whereas an equal number of males and females will be affected by an autosomal disorder.*
- *A person can inherit the X-linked recessive mutation that causes CAIS only from his mother, whereas a person can inherit an autosomal recessive mutation from his mother or father.*
- *A person who is genetically male will have CAIS if he inherits one copy of the recessive mutation that causes the disorder, whereas a person will have an autosomal recessive disorder only if he or she inherits two copies of a recessive mutation.*
- *A person who has CAIS can never be genetically female (i.e., have two X chromosomes), whereas a person who has an autosomal recessive disorder could be male or female.*
- *A person can never inherit the recessive mutation that causes CAIS from his or her father, whereas a person can inherit an autosomal recessive mutation from his or her father.*
- *CAIS is passed from mothers to sons, whereas females and males have an equal chance of getting an autosomal disorder from their mothers and/or their fathers.*

- **Explain** how CAIS can remain in the population when people who have the disorder are infertile. **Hypothesize** how the frequency of CAIS in the population could change in the future.

*Although people who have CAIS cannot pass the disorder on to their offspring, carriers of the disorder pass the recessive mutation on to their offspring. Therefore, the recessive allele associated with CAIS remains in the population.*

*The frequency of CAIS will decrease in the future because individuals with the disorder cannot reproduce, and therefore the mutated gene is not passed on as frequently as other mutations.*

**or**

*The frequency of CAIS will remain the same because the individuals who are carriers can pass on the mutated gene to their offspring.*

**or**

*Any other reasonable hypothesis*

- **Identify** two technologies that could be used to diagnose CAIS. **Describe** how each technology would provide evidence of the disorder.

*A karyotype of a CAIS female would show that her sex chromosomes are XY.*

*A pelvic examination of a CAIS female would indicate that no uterus is present.*

*An ultrasound image of a CAIS female would indicate that no uterus is present.*

*An ultrasound image of a CAIS female would indicate the presence of testes in the abdomen.*

*An MRI of the abdomen and pelvis could be taken to indicate whether testes or ovaries are present.*

*Exploratory surgery of the abdomen and pelvis could be performed to determine whether male or female reproductive organs are present.*

*Mapping the X chromosome could be used to check for the presence of the mutated gene causing CAIS.*

**or**

*Any other reasonable answer*

- **Describe** one individual issue that could arise when an athlete with CAIS competes in sporting events. **Describe** two reasons why the process of female sex verification challenges a governing body of sport such as the IOC.

***Individual issues:***

- *People with CAIS who compete as females might have a competitive advantage over others in women's sporting events.*
- *People with CAIS who compete as males might not be able to match the strength and physical fitness of other male athletes even though they are genetically male.*
- *A person with CAIS who competes in sporting events could experience a violation of personal privacy as a result of blood/urine tests taken after the competition.*
- *If the person with CAIS is disqualified from competing in a team sport, other members of the team could be disqualified or could experience undue stress.*
- *Athletes with CAIS might feel discriminated against if they are not allowed to compete simply because of their unusual anatomy/genetics.*
- *It is unfair to ask all female athletes to submit to sex verification tests for the purposes of identifying a single rare genetic disorder.*
- *Testing all female athletes could put undue stress on them before or during competition and thus impair their athletic performance.*

***or***

*Any other reasonable issue*

***Governing bodies of sport are challenged for the following reasons:***

- *The reliability of the method of sex verification could be challenged.*
- *The method of sex verification used might not be sufficient to make a final ruling in all cases.*
- *Some athletes might feel that governing bodies of sport should test not only females but also males.*
- *Female sex verification could be considered to be sexist and unfair to women.*
- *People might think that resources and money used to develop sex-verification tools could be better spent monitoring athletes' use of performance-enhancing drugs.*
- *Female sex verification could be considered to be irrelevant if a large number of female athletes are using male hormones and other drugs to enhance their athletic performance.*
- *It is very expensive to carry out sex-verification tests on a large number of female athletes when the CAIS disorder is so rare.*

***or***

*Any other reasonable answer*

## Science

### Technology and Society

Score	Scoring Criteria
<b>5 Excellent</b>	<ul style="list-style-type: none"> <li>• describes two reasons for infertility and completely explains how FSH could increase fertility in a person without CAIS but not in a person with CAIS</li> <li>• explains how CAIS can be inherited from unaffected parents and explains two ways in which the inheritance of CAIS differs from that of an autosomal disorder</li> <li>• explains how CAIS can remain in the population and writes a complete hypothesis</li> </ul>
<b>4 Good</b>	<ul style="list-style-type: none"> <li>• describes one reason for infertility and writes a complete explanation <b>or</b> describes two reasons for infertility and writes a partial explanation</li> <li>• explains how CAIS can be inherited from unaffected parents and explains one way in which the inheritance of CAIS differs from that of an autosomal disorder <b>or</b> explains two ways in which the inheritance of CAIS differs from that of an autosomal disorder</li> <li>• partially explains how CAIS can remain in the population and writes a complete hypothesis <b>or</b> explains how CAIS can remain in the population and writes a partial hypothesis</li> </ul>
<b>3 Satisfactory</b>	<ul style="list-style-type: none"> <li>• describes two reasons for infertility <b>or</b> writes a complete explanation <b>or</b> describes one reason for infertility and writes a partial explanation</li> <li>• explains how CAIS can be inherited from unaffected parents <b>or</b> explains one way in which the inheritance of CAIS differs from that of an autosomal disorder</li> <li>• explains how CAIS can remain in the population <b>or</b> writes a complete hypothesis <b>or</b> partially explains how CAIS can remain in the population and writes a partial hypothesis</li> </ul>
<b>2 Limited</b>	<ul style="list-style-type: none"> <li>• describes one reason for infertility <b>or</b> describes the role of FSH in fertility</li> <li>• attempts to explain how CAIS can be inherited from unaffected parents <b>or</b> describes one aspect of autosomal or sex-linked inheritance</li> <li>• partially explains how CAIS can remain in the population <b>or</b> writes a partial hypothesis</li> </ul>
<b>1 Poor</b>	<ul style="list-style-type: none"> <li>• addresses only one of the three bullets at a 2 or a 3 level</li> </ul>
<b>0 Insufficient</b>	<ul style="list-style-type: none"> <li>• does not address the question presented <b>or</b> provides an answer that is too brief to assess</li> </ul>
<b>NR</b>	<ul style="list-style-type: none"> <li>• does not provide a response</li> </ul>
Score	Scoring Criteria
The student ...	

<p style="text-align: center;"><b>5</b> <b>Excellent</b></p>	<ul style="list-style-type: none"> <li>• identifies two technologies that could be used to diagnose CAIS and describes how the two technologies would provide evidence of CAIS</li> <li>• describes one individual issue and describes two reasons why a governing body of sport is challenged</li> </ul>
<p style="text-align: center;"><b>4</b> <b>Good</b></p>	<ul style="list-style-type: none"> <li>• identifies two technologies and describes how one technology would provide evidence of CAIS <b>or</b> identifies one technology and describes how two technologies would provide evidence of CAIS</li> <li>• describes one individual issue and describes one reason <b>or</b> describes two reasons</li> </ul>
<p style="text-align: center;"><b>3</b> <b>Satisfactory</b></p>	<ul style="list-style-type: none"> <li>• identifies one technology and describes how the technology would provide evidence of CAIS <b>or</b> identifies two technologies <b>or</b> describes how two technologies would provide evidence of CAIS</li> <li>• describes one issue <b>or</b> describes one reason</li> </ul>
<p style="text-align: center;"><b>2</b> <b>Limited</b></p>	<ul style="list-style-type: none"> <li>• identifies one technology <b>or</b> describes how a technology would provide evidence of CAIS</li> <li>• attempts to describe one issue or one reason</li> </ul>
<p style="text-align: center;"><b>1</b> <b>Poor</b></p>	<ul style="list-style-type: none"> <li>• addresses only one of the two bullets at a 2 level</li> </ul>
<p style="text-align: center;"><b>0</b> <b>Insufficient</b></p>	<ul style="list-style-type: none"> <li>• does not address the question presented <b>or</b> provides an answer that is too brief to assess</li> </ul>
<p style="text-align: center;"><b>NR</b></p>	<ul style="list-style-type: none"> <li>• does not provide a response</li> </ul>

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