Information Bulletin
Biology 30

Diploma Examinations Program **2023–2024**

Alberta

This document was primarily written for:	
Students	
Teachers	✓ of Biology 30
Administrators	
Parents	
General Audiences	
Others	

2023–2024 Biology 30 Information Bulletin

Distribution: This document is posted on the Alberta Education website.

Contents

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.

Introduction

The purpose of this bulletin is to provide teachers of Biology 30 with information about the diploma examinations scheduled in the 2023–2024 school year. This bulletin should be used in conjunction with the current Biology 30 Program of Studies.

This bulletin includes information about the *Biology 30 Diploma Examinations* that will be administered in November 2023 and January, April, June, and August 2024; clarifications of some aspects of the examinations; descriptions of trends in student performance on previous examinations; and other subject-specific information.

Diploma exams will be weighted at 30%, and the school-awarded mark will constitute 70% of a student's final mark.

Teachers are encouraged to share the contents of this bulletin with students.

For further information about program implementation, refer to the Alberta Education website.

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 viewed 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. However, for the January and June administrations only, teachers will be allowed access to a teacher perusal copy for review purposes one hour after the examination has started.

For mathematics and science diploma examinations: All diploma examination booklets must be kept secure before, during, and after administration, without exception.

For humanities diploma examinations: The humanities Part A: Written Response booklets in the January and June administrations must be kept secure until after they are administered. All other humanities Part A: Written Response booklets, and all humanities Part B booklets, must be kept secure before, during, and after administration, without exception.

Unused copies of all secured diploma examinations must be returned to Alberta Education as per the dates indicated in the *Significant Dates at-a-Glance*.

For more information about teacher perusal copies and examination security, please refer to the Administering diploma exams web page.

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 allowed.

Although extra time is allowed for diploma examinations in all subjects, the total time allowed is not the same in all subjects. For more information about accommodations and provisions for students, please refer to the Administering diploma exams web page.

Equating to Maintain 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 on the Administering diploma exams web page.

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

Some subjects may have two distinct forms (versions) of diploma examinations during major administrations (January and June). The two forms are equated to the baseline examination 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

Diploma exam format, content, confirming standards, marking, results reporting
Diploma.exams@gov.ab.ca

or

French Assessment
French.Assessment@gov.ab.ca

or

Diploma exam security, diploma exam rules, scheduling, policy issues
Exam.admin@gov.ab.ca

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 the *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 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 Diploma Exam Lead, at Shannon.Mitchell@gov.ab.ca or Nathan Gilborn, Examiner, at Nathan.Gilborn@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 and appropriateness of the questions. Each field test requires a large student sample to provide the examination developers with reliable information (i.e., 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, the adequacy of writing-time limits, test length, text readability, artwork/graphics clarity and suitability, and question difficulty.

Science field tests

Science field tests are offered exclusively through the Quest A+ online delivery system.

Students may 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 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 numerical-response items blank. Test items address learning outcomes in the program of studies, which allows teachers to use field-test results to learn more about their students' strengths and areas for improvement.

Teachers have a 24-hour window to peruse digital field tests. Once logged into the digital 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.

More information about field-test registration deadlines, administration, and security is available at the Teacher participation in provincial assessments web page.

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 at the Teacher participation in provincial assessments web page, or by contacting Field.Test@gov.ab.ca.

Digital field tests

Digital field tests are offered through the Quest A+ online delivery system for Session 1. Please refer to the *Field Test Rules and Request Guide 2023–2024* for more information regarding Session 2.

For more information, contact

Diploma exam format, content, confirming standards, marking, results reporting
Diploma.exams@gov.ab.ca

or

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Biology 30 Field Testing

All Biology 30 field tests are offered in a digital format, and a few different types are available: end-of course field tests, unit field tests, and mini field tests.

End-of-course field tests have questions related to outcomes in all four units of the program of studies; unit field tests have questions related to outcomes in one single unit; and mini field tests target specific outcomes within a unit.

The following table summarizes the format, number of questions, and length of time for the various field tests available in the 2023–2024 school year. Teachers may wish to consider this table when requesting a field test placement.

	Unit Tests	**Mini Field Tests**	**End-of-course Tests**	
Number of questions (MC and NR)	20–25	10	20–25	30–35
Test Time* (min)	50	30	50	65
Program of Studies coverage	Unit A: Nervous and Endocrine Systems	Endocrine	All four units	
	Unit B: Reproduction and Development	Reproduction		
	Unit C: Cell Division, Genetics, and Molecular Biology	Genetics		
	Unit D: Populations and Communities	Hardy–Weinberg		

*For all field tests, students are allowed an extra 15 minutes of writing time if it is available.

Each unit field 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.

Each mini field test is designed to take 30 minutes of writing time and has 10 questions. The Endocrine mini field test targets applications of hormones; the Reproduction test targets applications of structure, function, and hormones; the Genetics test targets Mendelian problem solving; and the Hardy–Weinberg test focuses on both theory and problem solving.

End-of-course 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.

An additional 10 minutes of administration time is required for each field-test administration period. For example, a class in which a 50-minute Biology 30 field test is to be administered should be a minimum of 60 minutes.

If your class periods are shorter than the total time required 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 amount of time for the field test.

Field tests can be scheduled either within class time or outside 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 answering questions of the kind used on diploma examinations that address learning outcomes in the program of studies, Alberta Education produces practice tests for most subjects that have a diploma examination. Students can access these practice tests using Alberta Education's Quest A+ online delivery system.

Special-format Practice Tests

To give students an opportunity to practise answering questions of the kind used on diploma examinations that address learning outcomes in the program of studies 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 Field.Test@gov.ab.ca.

Audio Descriptions

A support document, *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 science diploma examination.

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.

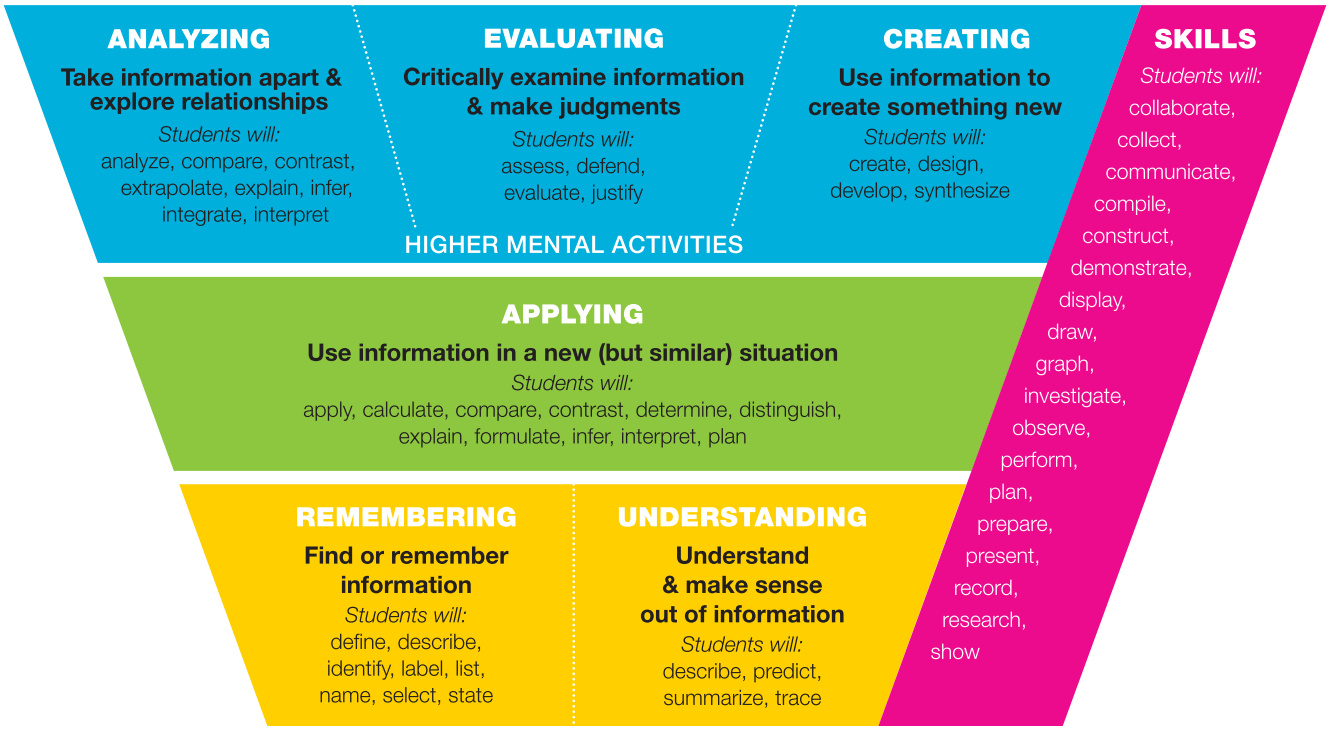
The revised Biology 30 Program of Studies was implemented in September 2008, and the first diploma examination on the revised program was administered in January 2009. The program was updated in 2014 to include links to mathematics.

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 help to 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 information arranged in a hierarchy, which is the arrangement used in the revised Bloom's taxonomy. The graphic is used fairly consistently in the four diploma examinations that assess science: Biology 30, Chemistry 30, Physics 30, and Science 30.



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

—based on Anderson, Krathwohl, and Bloom, 2001.

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

Note that difficulty is independent of cognitive level. Outcomes at any of the three cognitive levels can be assessed at either the acceptable standard or the standard of excellence.

Questions Illustrating Various Cognitive Levels

The first part of this section contains four questions that illustrate a progression through cognitive levels in one area of the program of studies: Genetics (C2).

Example 1

Which of the following statements does **not** represent a description of the inheritance of an autosomal recessive allele?

A. The allele may skip generations.
B. The allele is masked by a dominant allele.
C. Males are more likely to inherit the allele than females.
D. Offspring must inherit the allele from both parents to express the phenotype.

Answer: C
Outcome: C2.2k
Cognitive level: R/U (remembering)

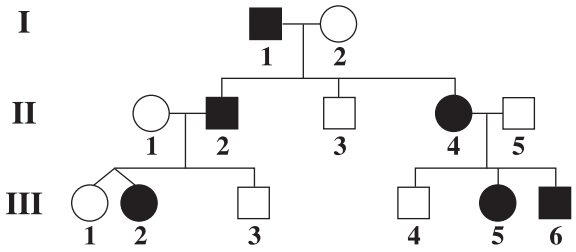
Students are provided with four descriptions of autosomal inheritance and must simply choose the one that does not describe autosomal recessive inheritance. Students are recalling what they have learned about autosomal recessive inheritance.

Example 2

Use the following information to answer the next question.

Polydactyly is a condition characterized by extra fingers and/or extra toes. It is caused by the presence of an autosomal dominant gene. The pedigree below illustrates the inheritance of polydactylism.

Pedigree Illustrating the Inheritance Pattern of Polydactylism



If individuals **II-4** and **II-5** have another child, the probability of this child having the polydactyly trait is

A. 0.25
B. 0.33
C. 0.50
D. 0.75

Answer: C
Outcome: C2.2k, C2.3s
Cognitive level: A

The pattern of inheritance is given in the context, and phenotypes are given in the pedigree, which students will use to calculate probability. They are applying what they have learned about inheritance to an unfamiliar pedigree and disorder.

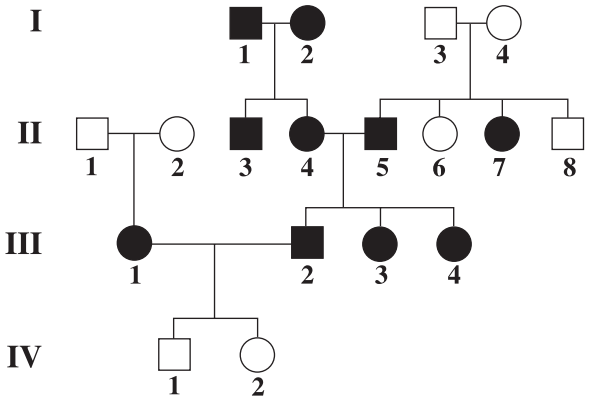
Example 3

Use the following information to answer the next question.

A form of congenital deafness is inherited as a result of the interaction between two genes, *D* and *E*, which assort independently.

Genotype	Phenotype
*D_E_*	Normal hearing
dd _ _	Deaf
_ _ ee	Deaf

Pedigree Illustrating the Inheritance of Congenital Deafness



The evidence in the pedigree that two different genes interact in the inheritance of congenital deafness is that

A. more female than male offspring are affected
B. individuals I-3 and I-4 produced affected offspring
C. individuals II-4 and II-5 produced affected offspring
D. individuals III-1 and III-2 produced unaffected offspring

Answer: D
Outcome: C2.2k, C2.3s
Cognitive level: HMA (evaluating)

The pattern of inheritance is not provided, and although phenotypes are given in the pedigree, affected individuals may have one of two traits because of gene interaction. Students must analyze the pedigree, integrating that information with the alleles given, and then evaluate the statements to justify the pattern of inheritance.

Example 4

Use the following information to answer numerical-response question 4.

The inheritance of colour in domestic pigeons involves several genes. The dominance hierarchy of three colour alleles is ash-red > blue-black > brown. These alleles are carried on the Z sex chromosome. A male pigeon has two Z sex chromosomes, and a female pigeon has one Z sex chromosome and one W sex chromosome.

A blue-black female pigeon is crossed with a brown male pigeon.

Numerical Response

4. What is the probability that the cross will produce brown offspring?

Answer: _____

(Record your answer **as a value between 0 and 1 rounded to two decimal places** in the numerical-response section on the answer sheet.)

Answer: 0.50
Outcome: C2.2k, C2.3s
Cognitive level: HMA (analyzing)

Students must integrate their knowledge of multiple alleles, dominance hierarchy, and sex-linked inheritance, and then analyze how those concepts apply to inheritance in an organism that has sex chromosomes opposite to those of humans. Students must then use that integrated information to calculate probability. Analysis and interpretation are required to answer this question.

The next part of this section contains examples of questions from various outcomes in the program of studies that illustrate different cognitive levels.

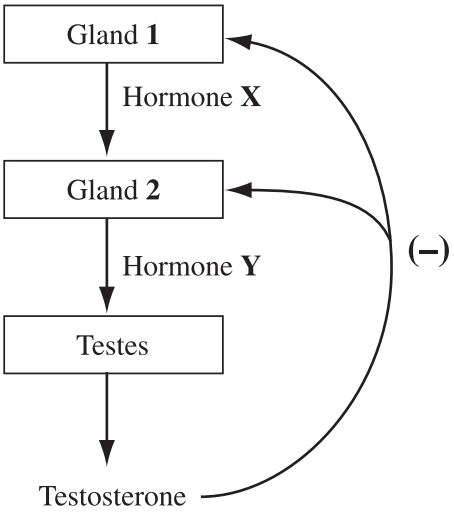
Remembering/Understanding (R/U) Level

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)

Regulation of Reproductive Hormones in Humans



Which of the following rows identifies Gland 1, Gland 2, Hormone X, and Hormone Y, as shown in the diagram above?

Row	Gland 1	Gland 2	Hormone X	Hormone Y
A.	Pituitary gland	Hypothalamus	LH	GnRH
B.	Hypothalamus	Pituitary gland	GnRH	LH
C.	Hypothalamus	Pituitary gland	GnRH	FSH
D.	Pituitary gland	Hypothalamus	FSH	GnRH

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

Applying (A) Level

Ecological Relationship		Definition		Example	
1	Predator–prey	**4**	An interaction where members of the same species compete for the same resources.	**7**	Aggressive salamanders are more successful at obtaining food compared to less aggressive salamanders.
2	Interspecific Competition	**5**	A relationship in which an organism kills and consumes another organism.	**8**	Squirrels and chipmunks compete for acorns.
3	Intraspecific Competition	**6**	An interaction where members of different species compete for the same resources.	**9**	A female lion hunts and captures a zebra and brings the food back to its pride.

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.)

Number: _____ _____ _____
Ecological relationship **Definition** **Example**

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

Answers: 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.

Genotype	Phenotype
mm	Full colour (either black or dark red)
Mm	Dilute colour (either grey or light red)
MM	White

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.

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

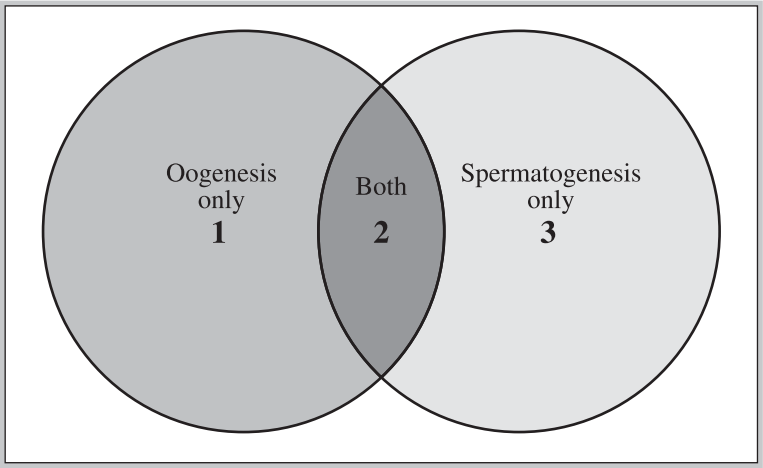
Match each statement related to the use of deslorelin with the consideration that describes it given below.

Statement:	_____	_____	_____	_____
Consideration:	**Societal**	**Technological**	**Economic**	**Ecological**

(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.)

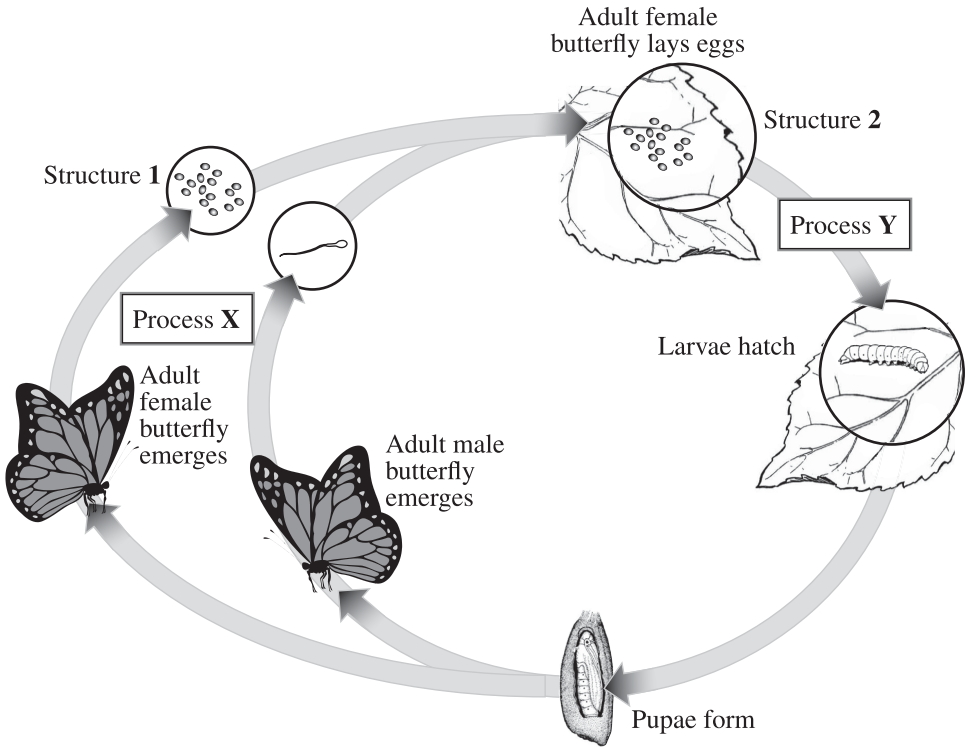
Number:	_____	_____	_____	_____
Description:	**Four daughter cells produced**	**Unequal cytoplasmic division**	**Stimulated by FSH**	**Daughter cells equal in size**

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

Answers: 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.

Life Cycle of a Butterfly



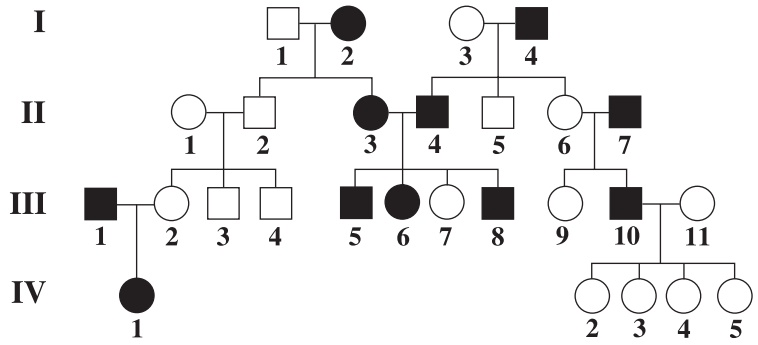
A karyotype of Structure 1 in the diagram above would have

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: C1.1k, C1.3k, and C1.3s
Cognitive level: HMA (analyzing)

Dentinogenesis imperfecta is a condition associated with thin tooth enamel. Using the pedigree below, a student concluded that dentinogenesis imperfecta is inherited in an autosomal recessive pattern.

A Pedigree Showing the Inheritance of Dentinogenesis Imperfecta



Which of the following rows **best** evaluates the correctness of the student's conclusion related to the pattern of inheritance displayed in the pedigree and explains why?

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

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

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.

Diploma exams are designed to match the program of studies of each subject, but what the diploma exams measure may not be the same in scope as what teachers measure. Diploma exam marks and teacher-awarded marks should reflect the same standard, however, because both assess students based on the same program of studies (curriculum). Alberta Education works with teachers to set and maintain the standards of achievement for diploma exams. This information bulletin is intended to assist teachers in understanding the provincial standards for Biology 30.

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 various viewpoints relating to a variety of issues and perspectives in the field of science and technology.

For more details on the relationship between the program of studies and performance standards, see the *Biology 30 Student-based Performance Standards*, a support document available on the Alberta Education website. 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.

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.

General Outcomes	Units of Study	Emphasis
A1, A2	**Nervous and Endocrine Systems** Students will explain how the nervous system controls physiological processes and how the endocrine system contributes to homeostasis.	**20–25%**
B1, B2	**Reproductive Systems and Hormones** 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	**Differentiation and Development** 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	**Cell Division and Genetics** 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	**Molecular Biology** Students will explain classical genetics at the molecular level.	**10–15%**
D1, D2, D3	**Population and Community Dynamics** Students will describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time; explain the interaction of individuals with one another and with members of other populations; and explain, in quantitative terms, the changes in populations over time.	**15–20%**

Scientific Process and Communication Skills	Science, Technology, and Society Connections (STS)
Students will • formulate questions about observed relationships and plan investigations of questions, ideas, problems, and issues • conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information • analyze data and apply mathematical and conceptual models to develop and assess possible solutions • work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results	The student can • explain that scientific knowledge and theories develop through hypotheses, the collection of evidence, investigation, and the ability to provide explanations • explain that scientific investigation includes the process of analyzing evidence and providing explanations based upon scientific theories and concepts • explain that the goal of technology is to provide solutions to practical problems • explain that science and technology are developed to meet societal needs and expand human capability • explain that science and technology have both intended and unintended consequences for humans and the environment • explain that decisions regarding the application of scientific and technological development involve a variety of perspectives, including social, cultural, environmental, ethical, and economic considerations • explain how science and technology have influenced, and have been influenced by, historical development and societal needs • explain that scientific research and technological development help achieve a sustainable society, economy, and environment • explain how concepts, models and theories are often used in interpreting and explaining observations and in predicting future observations • explain why Canadian society supports scientific research and technological development to facilitate a sustainable society, economy, and environment

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 2023–2024 *Biology 30 Diploma Examination* is as follows:

Question Format	Number of Questions	Percentage Emphasis
Multiple Choice	48	80
Numerical Response	12	20

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

The personal information collected through the Diploma Examinations Program is collected for the purpose of administering the program as well as support programs, policy evaluation, and measurement. This personal information collection is authorized by section 33(c) of the *Freedom of Information and Protection of Privacy Act* and by section 18(4) of the *Education Act*. If you have any questions about the collection of personal information, you may contact the Director, Diploma Programs, Provincial Assessment Sector, System Excellence, at 780-422-5160, by email at Janet.Rockwood@gov.ab.ca or by mail to 6th floor, 10044 108 Street NW, 44 Capital Boulevard, Edmonton, Alberta T5J 5E6.

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

- Turn to the last page of the examination booklet. Carefully fold and tear out the machine-scored answer sheet along the perforation.

***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.*

- 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 may use **one** approved calculator: **either** a scientific calculator that does not have prohibited properties **or** a 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.

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

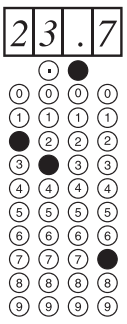
Calculation Question and Solution

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**

Record 23.7 on the answer sheet →



Fill in the corresponding circles

Sequencing Question and Solution

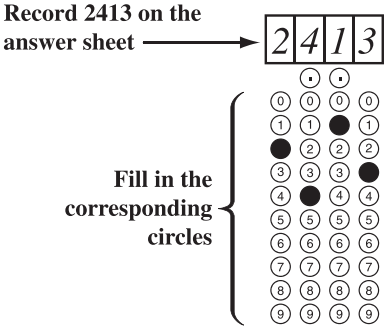
Four Subjects

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

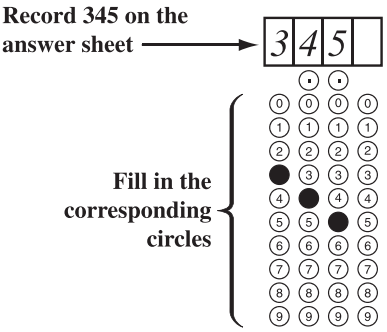
Five Subjects

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?

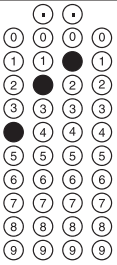
Ratio: _____ : _____ : _____
Colour: **Green** **Blue** **White**

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

Answer: **421**

Record 421 on the answer sheet → 4 2 1

Fill in the corresponding circles



Multiple-answer Matching Question and Solution

Continent	Country	Capital City
1 North America	**4** France	**7** Beijing
2 Europe	**5** China	**8** Ottawa
3 Asia	**6** Canada	**9** Paris

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.)

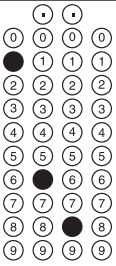
Number: _____ _____ _____
Continent **Country** **Capital city**

(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 → 1 6 8

Fill in the corresponding circles



Note: The answers 168, 249, or 357 will be scored as correct.

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.

BIOLOGY DATA

Symbols

Symbol	Description
D_p	population density
N	number of individuals in a population
A	area occupied by a population
V	volume occupied by a population
t	time
Δ	change in
K	carrying capacity
gr	growth rate
cgr	per capita growth rate
$>$	greater than, dominant over
$<$	less than, recessive to

Symbol	Description
♂	male
♀	female
n	chromosome number
B, b	alleles: upper case is dominant, lower case is recessive
I^A, I^B, i	alleles, human blood type (ABO)
P	parent generation
F_1	first filial generation
F_2	second filial generation
p	frequency of dominant allele
q	frequency of recessive allele

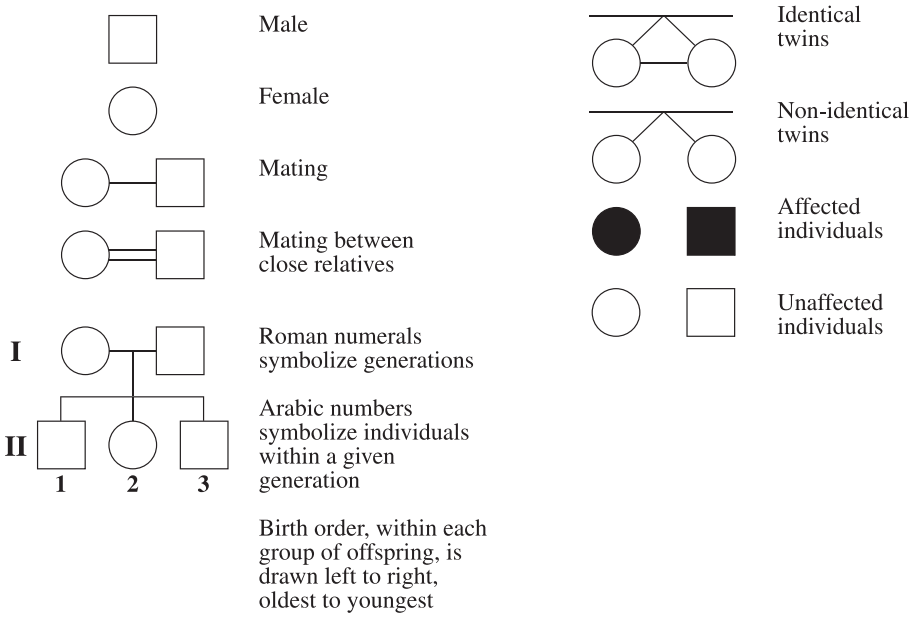
Equations

Subject	Equation
Hardy–Weinberg principle	$p^2 + 2pq + q^2 = 1$
Population density	$D_p = \frac{N}{A}$ or $D_p = \frac{N}{V}$
Change in population size	$\Delta N =$ (factors that increase pop.) – (factors that decrease pop.)
Growth rate	$gr = \frac{\Delta N}{\Delta t}$
Per capita growth rate (time will be determined by the question)	$cgr = \frac{\Delta N}{N}$

Abbreviations for Some Hormones

Hormone	Abbreviation
Adrenocorticotropic hormone	ACTH
Antidiuretic hormone	ADH
Follicle-stimulating hormone	FSH
Gonadotropin-releasing hormone	GnRH
Human chorionic gonadotropin	hCG
Human growth hormone	hGH
Luteinizing hormone	LH
Parathyroid hormone	PTH
Prolactin	PRL
Thyroid-stimulating hormone	TSH

Pedigree Symbols



Messenger RNA Codons and Their Corresponding Amino Acids

First Base	Second Base				Third Base
	U	C	A	G	
U	UUU phenylalanine	UCU serine	UAU tyrosine	UGU cysteine	U
	UUC phenylalanine	UCC serine	UAC tyrosine	UGC cysteine	C
	UUA leucine	UCA serine	UAA stop**	UGA stop**	A
	UUG leucine	UCG serine	UAG stop**	UGG tryptophan	G
C	CUU leucine	CCU proline	CAU histidine	CGU arginine	U
	CUC leucine	CCC proline	CAC histidine	CGC arginine	C
	CUA leucine	CCA proline	CAA glutamine	CGA arginine	A
	CUG leucine	CCG proline	CAG glutamine	CGG arginine	G
A	AUU isoleucine	ACU threonine	AAU asparagine	AGU serine	U
	AUC isoleucine	ACC threonine	AAC asparagine	AGC serine	C
	AUA isoleucine	ACA threonine	AAA lysine	AGA arginine	A
	AUG methionine*	ACG threonine	AAG lysine	AGG arginine	G
G	GUU valine	GCU alanine	GAU aspartate	GGU glycine	U
	GUC valine	GCC alanine	GAC aspartate	GGC glycine	C
	GUA valine	GCA alanine	GAA glutamate	GGA glycine	A
	GUG valine	GCG alanine	GAG glutamate	GGG glycine	G

*Note: AUG is an initiator codon and also codes for the amino acid methionine.

**Note: UAA, UAG, and UGA are terminator codons.

Information about Nitrogen Bases

Nitrogen Base	Classification	Abbreviation
Adenine	Purine	A
Guanine	Purine	G
Cytosine	Pyrimidine	C
Thymine	Pyrimidine	T
Uracil	Pyrimidine	U

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.

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.

Sample Question

Use the following information to answer numerical-response question 1.

Amniotic stem cells are fetal cells that can be removed from amniotic fluid and then grown in a lab to produce specific types of cells. Embryonic stem cells are cells that can be removed from an embryo and then grown in a lab to produce specific types of cells.

Some Statements Related to Stem Cells

1 Governments may restrict funding for stem cell research.

2 Amniotic stem cells and embryonic stem cells are grown in cultures in a lab.

3 More than 4 500 Canadians are currently waiting for an organ transplant. Researchers are hopeful that certain organs may be grown from stem cells in the future.

4 The use of amniotic fluid stem cells is not as controversial as the use of embryonic stem cells. Some people disapprove of the use of embryonic stem cells because it involves destruction of the embryo from which the cells are taken.

Numerical Response

1. Match each statement related to stem cells numbered above with the consideration that **best** describes it given below. (Use each number only once.)

Number:	_____	_____	_____	_____
Consideration:	**Ethical**	**Societal**	**Economic**	**Technological**

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

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.

Sample Question

Use the following information to answer question 2.

The genome of *Drosophila melanogaster,* or fruit fly, has been fully sequenced. One gene that is located on the X chromosome is the gene for crossveinless wings.

D. melanogaster have three pairs of homologous chromosomes and two sex chromosomes. Female flies carry two X chromosomes, whereas male flies have one X chromosome and one Y chromosome. The crossveinless trait is recessive.

Campbell, Neil A. 1987. *Biology.* Menlo Park: The Benjamin/Cummings Publishing Company, Inc.

A female fly that is a carrier for crossveinless wings is crossed with with a male fly that has crossveinless wings.

2. What is the probability that the cross described will produce female flies with crossveinless wings?

A. 0.13
B. 0.25
C. 0.50
D. 0.75

Trends in Student Performance

On previous Biology 30 diploma examinations, students have shown that they are very good at addressing questions requiring them to demonstrate basic knowledge of biology. In general, students are challenged by questions requiring them to apply their acquired knowledge to new contexts and by questions requiring them to integrate concepts across units. The vast majority of students are 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 January and June 2023 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

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Describing functions of sensory and motor neurons	• Identifying types of neurons present in the CNS and the PNS	• *Identifying dendrites as axon terminals, and vice versa, on a diagram of the neuron*
• Applying knowledge of depolarization to a new context	• Relating threshold and all-or-none response to membrane potential	
• Identifying structures of the synapse on diagrams and by their descriptions • Applying knowledge of the synapse to new contexts	• Predicting the effect of an external factor that alters the synapse on the flow of ions and membrane potential in the post-synaptic membrane	
• Interpreting diagrams of reflex arcs and identifying roles of some of the structures involved		• *Identifying the motor neuron as the effector in a reflex pathway*
• Explaining how damage to one aspect of a reflex pathway alters the response		
• Identifying parts of the brain on a diagram	• Differentiating the functions of the frontal and parietal lobes of the cerebrum	
• Interpreting diagrams of the eye and the ear • Describing the functions of structures in the eye and ear	• Differentiating the location of sensory receptors for hearing from sensory receptors for equilibrium	

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Identifying the names and locations of glands that secrete hormones • Identifying the functions of most hormones • Interpreting contexts to predict the regulation of hormone secretion through negative feedback, especially those involving TSH and thyroxine • Understanding the relationship between ACTH and cortisol • Interpreting contexts related to the action of insulin and diabetes mellitus	• Interpreting diagrams comparing nervous and endocrine control of the stress response • Differentiating the functions of aldosterone and cortisol • Interpreting contexts related to bone metabolism, calcitonin, and PTH • Predicting how altering the secretion of hormones affects the composition of urine • Describing the specific effect of glucagon on blood-glucose level	• *Aldosterone targets the adrenal gland*

Unit B: Reproduction and Development

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Identifying structures of human reproductive systems • Describing the functions of structures in human reproductive systems • Understanding the relationship between the *Sry* gene, the Y chromosome, and the development of sex characteristics	• Understanding the difference between primary and secondary sex characteristics	
• Identifying accessory glands in the male reproductive system	• Differentiating developing sperm from surrounding structures • Differentiating the functions of the seminal vesicle, Cowper's gland, and the prostate gland • Identifying the function of Sertoli cells • Drawing conclusions from data and describing the relationship between variables based on evidence	• *Identifying Sertoli cells as interstitial cells, and vice versa, in a cross section of a testis*
• Differentiating the follicle from the corpus luteum in diagrams and cross sections	• Interpreting diagrams showing changes in the endometrium and the ovary	• *Identifying the endometrium and cervix as structures that secrete reproductive hormones* • *Identifying the follicle as the structure that secretes FSH*
• Identifying the functions of reproductive hormones	• Interpreting a diagram of a feedback loop to identify LH and testosterone • Understanding the interactions among reproductive hormones, and predicting how external factors alter feedback mechanisms	

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Predicting the effect of a change in FSH secretion on estrogen secretion	• Understanding the feedback effects of ovarian hormones on pituitary hormones • Arranging events in the menstrual cycle in the order in which they normally occur • Interpreting a graph showing changing levels of hormones during the menstrual cycle	
• Identifying zygote formation, both as a description and on a diagram, as the first step in human development • Identifying the placenta on a diagram and describing its function	• Arranging events in development in the order in which they would occur • Identifying structures that arise from embryonic germ layers • Differentiating the placenta from the amnion in a diagram	

Unit C: Cell Division, Genetics, and Molecular Biology

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Interpreting contexts related to ploidy, including those other than haploid and diploid • Interpreting diagrams or descriptions of karyotypes to identify a chromosomal disorder and sex of the cells • Interpreting diagrams of the cell cycle to identify interphase • Understanding that DNA replication takes place during interphase • Identifying events that take place during phases of mitosis when the phases are named • Identifying phases of mitosis when cells are arranged in the order in which the phases occur	• Interpreting a karyotype and ploidies of various organisms to determine the organism and type of cell represented	
• Identifying the events that take place during phases of meiosis when the phases are named • Identifying that, in humans, mitosis produces somatic cells and meiosis produces gametes • Interpreting contexts involving crossing over and/or nondisjunction	• Differentiating phases in mitosis with parallel phases of meiosis based on the arrangement of chromosomes (e.g., prophase of mitosis vs. prophase I) • Differentiating diagrams of meiosis I and II by the appearance of chromosomes	• *Identifying reduction division as occurring during meiosis II rather than meiosis I*
• Interpreting life cycles in which ploidy is given to identify where mitosis and meiosis take place	• Interpreting life cycles to determine ploidies of structures • Interpreting life cycles to determine where genetic variation could potentially increase	

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Working with many different types of genetics contexts and symbols to solve simple and complex genetics problems • Determining genotypes and phenotypes • Combining different types of inheritance (e.g., autosomal alleles, X-linked alleles, gene interaction, codominance, and multiple alleles) • Calculating ratios and probabilities • Interpreting contexts describing aspects of a trait's inheritance to identify the pattern of inheritance • Choosing a pedigree that illustrates an identified pattern of inheritance • Interpreting chromosome maps and calculating map distances	• Deciding when to use the product rule and when not to • Using the product rule when calculating probabilities for X-linked traits • Calculating probability based on information in a pedigree	• *Predicting the behaviour of two genes on a chromosome without drawing the chromosome map*
• Identifying Watson and Crick's model of DNA • Understanding the structure of DNA and how it replicates • Determining an mRNA sequence from a DNA sequence • Understanding the roles of restriction enzymes and ligase, and applying knowledge of these enzymes to new contexts	• Differentiating between a nitrogen base and a nucleotide • Identifying transcription as translation, and vice versa, in diagrams of protein synthesis • Identifyng a gene sequence from an amino acid sequence • Determining the change in amino acid sequence given a diagram of a mutation in DNA • Determining anticodons on tRNA	

Unit D: Population and Community Dynamics

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Understanding factors affecting genetic diversity in a population, especially the founder effect, the bottleneck effect, and natural selection		
• Calculating a gene frequency given the frequency of a phenotype (e.g., calculating q from q^2)	• Interpreting a context to determine the proportion of a population that is heterozygous for a trait	• *Using q^2 to represent the frequency of an allele* • *Using $2pq^2$ to represent the frequency of a heterozygous genotype* • *Using p^2 or p to represent all members of a population who have the dominant phenotype (rather than $p^2 + 2pq$)*
• Interpreting contexts to identify symbiotic relationships and types of competition between organisms	• Interpreting a context to differentiate between interspecific competition and intraspecific competition	
• Interpreting contexts related to ecological succession to differentiate between pioneer and climax species	• Interpreting a context to differentiate between primary and secondary succession	
• Identifying factors that increase environmental resistance exerted on a population	• Interpreting contexts involving environmental resistance and predicting the effect on other aspects of ecology, such as genetic diversity and succession • Predicting how changes in a population or community affect the environmental resistance exerted on a population	
• Understanding how natality, mortality, immigration, and emigration affect population growth		

Areas of Strength	Opportunities for Improvement	Most Common Errors
• Calculating growth rate (gr) • Evaluating gr calculations for correctness • Determining whether gr and cgr are positive or negative • Calculating population density • Interpreting population density data presented in both tables and graphs • Classifying traits of various species as being relatively *r*-selected or *K*-selected, including placing them on a continuum • Interpreting graphs to identify a population's reproductive strategy and growth pattern • Identifying a growth pattern as being logistic or exponential • Evaluating a context to identify four different perspectives	• Calculating per capita growth rate (cgr) • Analyzing experimental population data and choosing the most appropriate way to present the data graphically	• *Dividing by the final population rather than the initial population when calculating cgr*

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.

For a full listing of all the clarifications that have appeared over the last number of years, please see the *Biology 30 Archived Bulletin*.

Publications and Supporting Documents

In addition to this Information Bulletin, the following documents are published by Alberta Education:

- *Biology 30 Archived Bulletin* Updated version available by August prior to the beginning of each school year
- *Biology 30 Student-based Performance Standards*
- *Biology 30 Released Items* Most recent version published in fall 2021, consisting of items from the *August 2021 Biology 30 Diploma Examination*
- *Biology 30 Exemplars*
- *Examples of Descriptions Used in Audio Versions of Science Diploma Exams*
- *A Guide for Students Preparing to Write the Diploma Examination: Biology 30 / Chemistry 30 / Physics 30 / Science 30*

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

Teacher participation in provincial assessments
contains information about marking, field testing, item development, and examination validation

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

Contacts 2023–2024

Provincial Assessment

Provincial Assessment,
Alberta Education
44 Capital Boulevard
10044 108 Street NW
Edmonton AB T5J 5E6

Alberta Education website: alberta.ca/education

Provincial Assessment

Diploma exam security, diploma exam rules, scheduling, policy issues

780-427-1857
Email: Exam.admin@gov.ab.ca

Results statements and rescores

780-427-1857
Email: Exam.admin@gov.ab.ca

Field Testing general inquiries

Email: field.test@gov.ab.ca

Special cases, accommodations, and exemptions

General inquiries

780-427-9795
780-415-9242
780-427-4215
Email: special.cases@gov.ab.ca

Diploma exam format, content, confirming standards, marking, results reporting

Email: Diploma.exams@gov.ab.ca

French Assessment

Email: French.Assessment@gov.ab.ca

Diploma exam registration/*myPass*
Alberta Education Help Desk

780-427-5318
Email: AE.helpdesk@gov.ab.ca

Inquiries about transcripts, detailed academic reports, and rewrite fees

780-427-5732
Email: StudentRecords@gov.ab.ca

Inquiries about school marks and mature student status

780-422-9337

Inquiries about diploma certificates

780-427-5732
Email: StudentRecords@gov.ab.ca

Student enrolment and marks

780-422-9337
Email: StudentRecords@gov.ab.ca

Digital Assessment

Email: online.assessment@gov.ab.ca

When contacting Alberta Education, please include your name, title, school name, school code, and, if referring to a student, include the student's Alberta Student Number.

Contacts 2023–2024

Provincial Assessment

*NEW **Satinder Dhillon, Executive Director**
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Diploma Programs

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Exam Administration

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Special Cases and Accommodations)
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