Archived Information Bulletin Biology 30

Diploma Examinations Program **2026–2027**

Alberta

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

2026–2027 Biology 30 Archived Information Bulletin

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You can find diploma examination-related materials on the Alberta Education and Childcare website.

Clarifications

Alberta Education and Childcare receives questions and feedback from teachers and students by email, by phone, at working-group sessions, and on field tests. In response to the questions and feedback received, the following points were provided for clarification in previous information bulletins.

Unit clarifications

Unit A: Nervous and Endocrine Systems

- Outcome A1.1k relates to the formation and transmission of an action potential and all-or-none response, a discussion of which would naturally include repolarization and refractory period. Although repolarization and refractory period are not explicitly named, their inclusion is implied, and therefore students should be familiar with the concepts.
- Outcome A1.4k states, in part, that students will describe the structure and function of specified structures of the eye, including the cornea and the choroid. Students should be aware that the functions of the cornea include both protecting the eye and refracting light into the eye. They should also be aware that the functions of the choroid include both the absorption of light and the supplying of oxygen and nutrients to the retina through blood vessels. Multiple functions for structures may not always be included in all approved resources.
- Outcome A1.5k relates to the structure and function of the parts of the human ear, with several structures listed. Although the ossicles are included in the list, students are not required to know the names of individual ossicles. It is more important for students to understand the role of the ossicles and to be able to apply that knowledge in a variety of contexts.
- Students should be aware of the prefixes *hypo* and *hyper* as they relate to elements in the Biology 30 Program of Studies. For example, an endocrine disorder could be described as resulting from the hypersecretion or hyposecretion of a particular hormone.
- Some teachers have asked if students should be learning about aldosterone specifically as a stress hormone. For the purpose of Biology 30, students are required to study only epinephrine and cortisol as hormones that relate specifically to stress. Outcome A2.2k specifies, in part, that students should be able to describe the relationship between ACTH and cortisol in addition to how they together maintain homeostasis through feedback. The relationship between ACTH and aldosterone is not present in the prescribed outcomes, and aldosterone secretion is controlled mainly by the renin-angiotensin system, which is beyond the scope of Biology 30. Students are still required to describe the function of aldosterone and explain its metabolic role in maintaining homeostasis, as outlined in A2.2k, A2.3k, A2.4k, and A2.6k.
- Outcomes A2.2k, A2.3k, A2.4k, A2.6k, and A2.3s refer to some hormones directly or indirectly involved in the regulation of water and ions. A discussion of the actions of the hormones and the physiological consequences of their imbalances is likely to include the use of the terms *dilute* and *concentrated*, which could refer to ions (e.g., sodium) or solutes (e.g., glucose) in urine or blood. Students should be familiar with the general meaning of those terms.
- Several outcomes (e.g., A2.3s, B2.3s, B3.3s) refer to analyzing data related to the concentrations of hormones and glucose in blood and urine. Others (e.g., A2.4s, B2.4s) refer to applying the conventions of science in communicating information. Students should therefore feel comfortable with units of concentration in general and should expect to see a variety of units used, as determined by the research or context presented.
- Outcome A2.3s refers to performing an experiment to investigate the presence of glucose in simulated urine and comparing the results with normal urinalysis data. Students who have completed this required skills outcome would have learned through the course of their experiment that no glucose is present in urine in a person with healthy glucose metabolism.
- Outcome A2.6k states that students will “describe … the physiological consequences of hormone imbalances; i.e., diabetes mellitus.” A full description of physiological consequences of diabetes mellitus includes differentiating between type 1 and

type 2 diabetes mellitus. Therefore, students should be able to describe how the physiological consequences of type 1 and type 2 diabetes mellitus differ from each other.

- Students should be familiar with the words *administration* and *administer*. Contexts in the *Biology 30 Diploma Examination* are often related to a particular disorder or condition that can be treated by administering a hormone or a drug. Students could see the use of the words *administration* or *administer* in this sense in a context or a question on the diploma examination.
- The concept of negative feedback remains important in Biology 30, particularly in units A and B. On a diploma examination, negative feedback could be depicted in a diagram or incorporated into a context. Students might be asked to interpret a diagram of a negative-feedback loop; however, they are more likely to be asked to think about hormone interactions and decide how the concept of negative feedback applies or might change in relation to a new context.
- Some teachers have asked if negative feedback should be represented in a diagram by a particular type of line, such as a dashed line. Consultation with technical reviewers who have academic expertise in endocrinology, reproductive endocrinology, and anatomy indicates that there is no specific convention, and a variety of styles can be used for lines representing feedback.

Unit B: Reproduction and Development

- In outcome B1.1k, the term *Fallopian tube* is used and therefore will be used on the examination rather than alternative vocabulary such as *oviduct* or *uterine tube*.
- Outcome B1.2k specifies the names of structures in the male reproductive system. The term *vas deferens* will be used on diploma examinations. The plural form of the term, *vasa deferentia*, is used when necessary, as is *epididymides*, the plural form of *epididymis*.
- The term *interstitial cells* refers to cells located in the spaces between functional cells of a tissue. These cells are found in many different tissues. In the context of the Biology 30 Program of Studies and diploma examinations, *interstitial cells* refers specifically to testicular interstitial cells and not those associated with any other tissues. (Many resources refer to testicular interstitial cells as Leydig cells, but this vocabulary will not be used on diploma examinations.)
- 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*.
- Diagrams of the ovary sometimes appear on diploma examinations as part of a context. Students should be aware that multiple structures are shown in the ovary at once (e.g., follicle and corpus luteum), even if those structures would not normally be present in an ovary at the same time. The diagrams of ovaries in the two approved textbooks are presented in the same way.
- Outcome B2.1k refers to the role of hormones, including GnRH, in the regulation of primary and secondary sex characteristics. Therefore, students can expect to see questions on the role of GnRH in human reproduction, including its interaction with other hormones and associated feedback mechanisms.
- Outcomes B2.2k and B2.3s relate to the physiology and hormone interactions involved in the menstrual cycle. For simplicity, the vocabulary used to refer to the four phases of the menstrual cycle are *flow phase* (or *flow)*, *follicular phase* (or *follicular stage*), *ovulatory phase* (or *ovulation*), and *luteal phase* (or *luteal stage*).
- Outcomes B2.2k and B2.3s refer to the interaction of reproductive hormones in the maintenance of the menstrual cycle. Some resources consider that the menstrual cycle includes changes in the ovaries as well as changes in the endometrial lining. Other resources consider that the menstrual cycle refers specifically to changes that occur in the uterus, (i.e., the uterine cycle). In diploma exams, the term *menstrual cycle* typically refers to the events that occur during an ovarian cycle and those that occur during the uterine cycle. Occasionally, the terms *ovarian cycle* or *uterine cycle* are used to refer to specific events that occur only in the ovaries or only in the endometrial lining, respectively. Students should be familiar with those terms.
- In embryonic development, the blastocyst stage is considered to be a continuum. Students are required to have general knowledge about a blastocyst and understand that cells become only slightly more differentiated over time during that

stage of development. They should understand that cells of the blastocyst are relatively undifferentiated compared to later developmental stages.

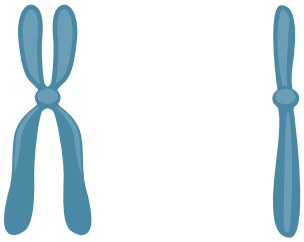
- Although the umbilical cord is not explicitly listed in outcome B3.1k, its inclusion is implied. The umbilical cord is very closely associated with both the allantois and the placenta, and so a discussion of early embryonic development would naturally include all three structures.
- Outcomes B3.2k and B3.3s indicate that students must describe development from fertilization to parturition in general terms, and the outcome includes the blastocyst along with other structures and processes. As a result, students are expected to have a general understanding that the inner cell mass of a blastocyst develops into the embryo and the outer layer of cells eventually contributes to the development of the placenta.
- Outcomes B3.2k and B3.2s indicate that students must describe human development and the effects of environmental factors in general terms. If students were given a context describing the effect of an environmental factor on the development of an organ system, general knowledge of development by trimester would be enough to enable students to address the question.

  For example, assume that a context described a teratogen that affects development of an organ system and a question asks the time of development when exposure to the teratogen is most likely to harm the embryo or fetus. Students have the knowledge that most organ development takes place in the first trimester, so they can easily apply that knowledge to the question by ruling out any time intervals later than 12 weeks. If the choices included time intervals that fall within the first trimester, then they would have the knowledge to reason through them as well. Because students have knowledge about fertilization and implantation (also specified in B3.2k), they could also rule out the time intervals earlier than five days, knowing that no organ development would have taken place yet.

  Beyond the zygote, the blastocyst, and the process of gastrulation, students are not required to know specific details of human development. Instead, they should focus on the general events that occur in each trimester. They will be well equipped to apply what they know to a new context.

Unit C: Cell Division, Genetics, and Molecular Biology

- The terms *haploidy*, *diploidy*, and *polyploidy* appear in 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.
- Contexts and questions about cell division (Unit C, General Outcome 1) sometimes require the description of chromosomes. Students should be familiar with the terms *condense*, *decondense*, *coil*, and *uncoil*. Chromosomes condense at the beginning of mitosis, and they decondense at the end of mitosis. Condensed chromosomes can be described as coiled, and decondensed chromosomes can be described as uncoiled.
- Sometimes the chromosome content of a cell is described as having two copies of each chromosome or as having one copy of each chromosome. The meaning of the word *copy* should not be taken literally; in this sense, the number of copies refers to the number of chromosomes present and the ploidy of the cell. For example, if a cell is described as having two copies of each chromosome, the meaning is that two chromosomes of any specific type are present in the cell and the cell is diploid. If a cell is described as having one copy of each chromosome, the meaning is that there is only one chromosome of each type present and the cell is haploid.
- Outcomes C1.2k, C1.3k, C1.4k, and C1.2s refer to describing, demonstrating, and comparing the processes of mitosis and meiosis. During certain phases of cell division, chromosomes have different appearances:



Chromosome **A** Chromosome **B**

In words, Chromosome A would be described as *duplicated*, and Chromosome B as *unduplicated*. Chromosome A could also be described as *replicated*, and Chromosome B as *unreplicated*, although the terms *duplicated* and *unduplicated* are preferred.

- Outcome C1.2k refers to the events of the cell cycle, specifically interphase, mitosis, and cytokinesis. Students are not expected to know G1, S, or G2 of interphase.
- In many cell types, the division of cytoplasm by cytokinesis typically occurs in conjunction with mitosis, ending in telophase. In some cell types, cytokinesis occurs after the completion of mitosis, but before the next interphase begins. Students should be aware that cytokinesis does not occur during interphase.
- Outcomes C1.3k and C1.4k relate to the process of meiosis, including the reduction of chromosome number and the comparison of meiosis with mitosis. Therefore, students should be familiar with the terms *tetrad*, *synapsis*, and *segregation*. (Segregation also appears in C2.1k.) These terms are used in both approved resources.
- The term *segregation* can be used to refer to processes that occur in both meiosis I and meiosis II. Chromosomes segregate in anaphase I, whereas chromatids segregate in anaphase II. It is also appropriate to refer to *separation* of chromatids in anaphase II. Both terms will be used in diploma examinations.
- Outcomes C1.3k, C1.4k, and C1.5k relate to meiosis, including the idea of crossing over. Students are expected to understand that crossing over generally begins in prophase I once tetrads have been formed.
- Outcomes C1.5k and C1.3s relate to nondisjunction and its significance to organism inheritance and development. Students are expected to know the meaning of the terms *monosomy* and *trisomy*, but they are not required to know the names of specific chromosomal disorders, such as Edward syndrome. If such names are used in a context, they will be described or defined.
- When students are solving problems related to Mendelian genetics, they should express genotypic and phenotypic ratios in lowest terms. For example, if the phenotypic ratio in the offspring of two parent plants is expected to be 6 red flowers to 2 white flowers, the ratio should be expressed as 3 red : 1 white (lowest terms) and not 6 red : 2 white. In certain cases, a solution to a problem might indicate that two parents would produce no offspring of a particular genotype or phenotype. Students would then simply indicate “0” in the ratio.
- Some people have asked how allele symbols are chosen for problems in Mendelian genetics. Whenever possible, the allele symbols used on the examination are those used in the scientific literature. If it is not possible to use the actual allele symbols, then simple letters that best reflect the traits in question are chosen. In all cases, the symbols used are then validated by academic experts in the fields of genetics and cell biology.
- In general, students should expect to express 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. In such cases, the question will clearly direct students to express their answer as a percentage probability. Students are encouraged to carefully read any instructions for expressing answers that may be included with the questions.
- Outcomes C2.2k, C2.5k, and C2.3s refer to inheritance patterns, genotypes, and phenotypes. Students are expected to understand the difference between a genotype and a phenotype. For example, if asked to predict a genotypic ratio, students should be looking for an alternative that includes genotypes (e.g., I^AI^B) rather than phenotypes (type AB blood). It is possible that both responses are present in the alternatives. Students need to choose the genotype or phenotype, as appropriate, to show that they understand the difference.
- Outcome C2.4k relates to the relationship between variability and the number of genes controlling a trait. This outcome is conceptual in nature and does not relate to the skill of solving genetics problems involving epistatic traits. Any skills-based questions that involve calculating probabilities or determining genotypes or phenotypes of epistatic traits will be classified as C2.2k and C2.3s and not as C2.4k.
- On diploma examinations, students are sometimes provided with information about genotypes or phenotypes of parents and asked to determine an aspect of the theoretical offspring. Students should assume that in these contexts provided as the basis for problem solving, the phrases *two parents* or *a man and a woman* refer to the biological, genetic parents of the theoretical offspring. The terms *man*, *woman*, *male*, and *female* are are not used unless absolutely necessary. Sometimes, these words cannot be avoided in contexts related to problem solving in genetics, especially when X-linked inheritance is involved, without significantly decreasing the clarity of the context.
- In certain resources, 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*.
- Students should expect to see questions on diploma exams relating to the historical events leading to the discovery of DNA, given that these aspects are present in the program of studies (C3.1k).

- When a strand of DNA is provided, students should transcribe mRNA from the base sequence in the strand of DNA given. For example, if the DNA strand given in a context is TGC AAC CTG and the student is asked for the corresponding amino acid sequence, the student would determine that the mRNA would be ACG UUG GAC and the amino acid sequence would be threonine—leucine—aspartate.
- The terms *purine* and *pyrimidine* are considered to be part of outcomes C3.2k and C3.2s, which are related to the structure of DNA. These terms are also defined in the data pages.
- The concept of cancer occasionally arises on a diploma examination. The area of the program of studies in which cancer appears is outcome C3.3s and specifically how "changes in genetic information … lead to heritable mutations and cancer." The implication is that students should broadly understand that changes in DNA can lead to uncontrolled mitosis, and cancer could be the result.
- Outcome C3.7k refers to mitochondrial DNA (mtDNA), which was always thought to have an exclusively maternal pattern of inheritance. In December 2018, Luo et al. published research in the *Proceedings of the National Academy of Sciences of the United States of America* (PNAS) suggesting some exceptional cases in which mtDNA seemed to be inherited from both parents. Since then, a series of rebuttals and responses to the original paper have been published, challenging the research methods, questioning the evidence, and proposing both alternative hypotheses and directions for further research.

  It is not appropriate to consider a finding from a single paper to be conclusively proving the paternal inheritance of mtDNA. The methods and findings must be reproduced and verified multiple times by multiple groups using multiple methods. For now, scientists consider the research to be interesting, yet inconclusive, and mtDNA is still considered to be maternally inherited only. The authors of the original paper themselves state that "the central dogma of maternal inheritance of mtDNA remains valid."

  Teachers are not discouraged from discussing this research with their Biology 30 classes. It is, however, recommended that a discussion of the original paper also include the accompanying rebuttals and responses. Taken together, they provide an excellent example of the process of science working as it should within a Biology 30 context.

Unit D: Population and Community Dynamics

- The first bulleted point under outcome D2.1k of the Biology 30 Program of Studies refers to producer–consumer relationships; therefore, this concept's appearance on a diploma examination should not be unexpected.
- Outcomes D2.3k and D2.2s relate to ecological succession. A discussion of primary and secondary succession would naturally include various stages of the processes, including a climax community. Although pioneer species, pioneer community, and climax species are not explicitly named, these concepts are foundational to the study of ecological succession. These concepts are considered to fall under the umbrella of succession, and students should be familiar with them.
- Outcome D3.2k includes the concept of biotic potential, which is the maximum number of offspring that can be produced by a population under optimal environmental conditions. Biotic potential is an unchanging characteristic of a population that could theoretically be reached if the population grows without restriction at the highest possible per capita growth rate (cgr). However, factors that exert environmental resistance on a population (e.g., limitation of food, insufficient space, insufficient light, disease, predators, competitors) prevent populations from reaching their biotic potential. Although growth rate (gr), birth rate, fertility, and fecundity are factors that affect the growth of a population, they are not synonymous with biotic potential.
- In the Biology 30 Program of Studies, the concept of open and closed populations appears in outcome D3.3k. 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.
- Outcomes D3.4k and D3.3s relate to characteristics and reproductive strategies of *K*-selected and *r*-selected organisms. Some organisms can be classified as either *r*-selected or *K*-selected because they display multiple traits that clearly exemplify one strategy or the other. However, many organisms exhibit characteristics of both strategies.

  Contexts in the diploma examination will provide students with the information they need in order to classify an organism as *r*-selected or *K*-selected. Alternatively, students could be given information about several traits within the same organism, some of which they would classify as *r*-selected and some of which they would classify as *K*-selected. In the past, students have consistently shown that they do not have difficulty with this concept, but they should be aware that both types of traits can exist in a single organism.

- Outcomes D3.3k and D3.4k are related to growth patterns and reproductive strategies. Students should not assume that a particular reproductive strategy is always associated with a particular growth pattern. For example, *K*-selected organisms most often have a logistic growth pattern, and *r*-selected organisms most often have an exponential growth pattern. There are some instances when this is not the case, depending on environmental conditions. It is important that students read and evaluate the context in order to determine the growth pattern of organisms living in specific conditions.
- Growth rate (gr) is the change in number of individuals in a population over time; therefore, time is included in the calculation of gr. However, cgr is the change in number of individuals in a population relative to the original number of individuals. It is not necessary to include time in the calculation of cgr. Although one of the approved resources shows an example of cgr being calculated over time, students are not expected to include time in their calculations of cgr on diploma examination questions.

General Clarifications

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

  Therefore, questions related to experimental variables in the context of any unit of study in Biology 30 should not be unexpected.
- The Biology 30 Program of Studies requires students to analyze and interpret data, including graphical data (e.g., A2.3s, B2.2s, B2.3s, B3.3s). As much as possible, graphical data are sourced from scientific research and presented authentically. Students will see new scenarios on diploma examinations to which they are expected to apply their acquired knowledge and skills, but they should be assured their course work has prepared them to be able to interpret these new contexts, graphical or otherwise.
- Students should be familiar with the word *analogous*, which is often used as a means of comparing two structures that are similar in form or in function. The vast majority of students will have had experience with this word while studying evolutionary biology in Biology 20 (Unit B: Ecosystems and Population Change, General Outcome 2).
- Some of the contexts used in diploma examinations refer to humans, and some refer to other species. In cases where the context does not specify an organism, students should assume that the context refers to humans.
- Sometimes words on diploma examinations appear in italics. Italicized text simply indicates that a word is not an English word, and it is not used to provide any particular emphasis. Italicized words are typically Latin or Greek, and examples include genus and species names of organisms.
- Outcomes B1.1sts, B2.2sts, B3.2sts, and C2.1sts require students to be able to identify, explain, evaluate, and apply a number of different perspectives, including social, cultural, environmental, ethical, and economic perspectives.
  - A social (or societal) perspective relates to society as a whole and a large group of people rather than one person or a small group of people such as a family.
  - A cultural perspective relates to behaviours, beliefs, and other characteristics of a particular group of people defined by the context.
  - An environmental perspective relates to aspects of ecology, including ecological management and human effects on the environment.
  - An ethical perspective relates to moral principles and a sense of right and wrong.
  - An economic perspective relates to the costs, benefits, and associated effects of the application of a particular technology.

  Sometimes, perspectives can overlap with one another, and in such cases, students will have to use their judgment to choose the perspective that is most strongly exemplified. In other situations where perspectives overlap, and depending on the question, more than one answer may be acceptable.
- Students should be familiar with the word *respectively*. For example, here is a correct statement: The genotype and phenotype of the plant are *Rr* and red, respectively. Here is an incorrect statement: The genotype and phenotype of the plant are red and *Rr*, respectively. The latter statement is incorrect because the use of *respectively* implies that, in this example, the genotype is stated first and the phenotype second.
- Some teachers have expressed concerns about whether artwork and diagrams with colour can be interpreted by students who have colour-blindness. The graphic artists who produce the images use colour-blindness filters to ensure that students with colour-blindness are able interpret the images. In addition, some of the people who are involved in the diploma exam development and review processes have colour-blindness, which is of great assistance in judging whether or not students would reasonably be able to interpret the images used. Students and teachers who find artwork difficult to interpret for any reason are encouraged to provide feedback.

- Some people have asked if multiple correct answers are accepted for some questions. Multiple correct answers are accepted when appropriate.
- Students should be advised that the calculator policy allows them to bring only one calculator into their diploma examination: either a scientific calculator that does not have prohibited properties, or a graphing calculator approved by Alberta Education and Childcare. A basic, four-function calculator that has a square root function is sufficient for the *Biology 30 Diploma Examination*. Students should plan on using an approved calculator or a scientific calculator that does not have prohibited properties and that they are experienced and comfortable with.