GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

Department of Education Evaluation, Testing, and Certification Division

Biology 3201 Course Clarifications

This document contains detailed marking schemes for items that are typically asked by teachers or items that students often have difficulty with. Common student errors or misconceptions are highlighted and some teaching suggestions are provided. This document will be reviewed by teachers every year and any recommended additions or corrections will be made at that time. Please contact me with any comments regarding this document.(ronsmith@gov.nl.ca)

Unit 1
Concept 1.1: Hormones

Item Example:	**Value**
Describe two reasons for supporting or two reasons for opposing prescribing HGH to a normal adult who is short in stature.	2%

Answer with Marking Scheme and Explanation:

The individual should be given HGH because it will promote normal high and and thus reduce the stigma of being below average high. The HGH will also help to ensure that the individual passes through puberty and develops as a normal adult from a reproductive point of view.	1%

Or

The individual should not be given HGH because it may promote acromegaly which promotes deformities that are not desirable. The HGH may also function similar to prolactin which could cause over development of the mammary glad and lead to lactogenesis.	1%

Common Errors and Misconceptions:

Throughout this course students will deal with issues that have two sides. It is important that teachers discuss both sides and question students on them. A common error with this type question is that students may only know one reason for and one reason against and give both these reasons and expect full marks. They have not recognized that this question is an either/ or question. Also, there are very many hormones in this unit and students often get confused and overwhelmed by the amount.

Concept: 1.2 Neurological Disorders

Students should be aware of the functioning of the reflex arc and how the functioning of the reflex arc can be impaired.

Item Example: **Value**

John has a job working in a kitchen as a cook's helper. He had to be rushed to the hospital because he unknowingly placed his hand on a hot stove and did not pull it away. Identify three neurological reasons why John did not withdraw his hand immediately. 2%

Answer with Marking Scheme and Explanation:

John may be unable to withdraw the hand immediately because he may have damaged the receptor in the skin of his hand at some previous time. He may be on a legal or illegal drug which prevents either the release or block the absorption of neurotransmitters. He may have unknowingly been exposed to chemicals such as concentrated pesticides which have done damage to the reflex arc. John may have damaged the association neuron, this would prevent the impulse from being passed from the sensory neuron to the master neuron.

Common Errors and Misconceptions:

A common error with this type question would be to describe the actual functioning of the reflex arc and not directly answer the question.

Student have to be aware that this question relates to problem with transmission, not the action.

Unit 2
Concept 2.1: Hormone Levels

Item Example: **Value**

Explain why only one corpus luteum may be found in the ovaries of a woman who has given birth to triplets. 2%

Answer with Marking Scheme and Explanation:

The triplets which the woman gave birth too may be identical. As a result the three children developed from only one egg, thus only one follicle was released from the ovary which gave rise to only one corpus luteum. 1%

It the triplets resulted from more than one egg which results from more than one follicle, only one corpus luteum will still develop because that corpus luteum produces sufficient progesterone to maintain the development of the uterine lining. 1%

Common Errors and Misconceptions:

Since there are so many hormones involved in this topic area, students often get confused and overwhelmed. They do not become familiar with the hormone regulation of the female body. (They think they already know how the body works.)

Concept 2.2: Sexual Reproduction in Plants

Item Example: **Value**

Sexual reproduction occurs in many types of organisms including plants and humans. Describe three ways in which sexual reproduction in humans is different from sexual reproduction in plants. 3%

Answer with Marking Scheme and Explanation: (1% each for any three of the below)

Plants	Animals
1. sperm released externally in pollen grains and land on the female	1. sperm released internally into the female
2. embryo produced must live of its own food source (endosperm)	2. embryo produced is nourished by the mother
3. sperm nuclei are produced by mitosis of a generative nucleus	3. sperm are produced by meiosis in the testes.

4. embryo in plants may lay dormant for years before growth begins	4. embryo begins to grow immediately
5. embryo protected by a seed coat	5. embryo protected by the amnion and other tissues of the mother
6. sperm transferred by external factors such as wind, insects, etc.	6. sperm transferred directly into the female by the male

Common Errors and Misconceptions:

Students often have difficulty with this topic in Biology 3201 because it is the only time that plants are discussed. Most plant work is done in Biology 2201. As a result, it is important that teachers briefly reflect on what was done in 2201 and connect it with what is done in 3201.

Concept 2.3: Menstrual Cycle

Item Example:

	Value
The normal length of a human female menstrual cycle is 28 days. For a female, however, who normally menstruates every 26 days, what is the approximate date when ovulation would most likely occur during her next menstrual cycle if it begins on March 20 and all conditions remain normal? Explain	2%

Answer with Marking Scheme and Explanation:

The female should ovulate on April 1. (April 2 would also be accepted since students will not be penalized for not knowing that there are 31 days in March.) **(1 mark)**

Since most females ovulate 14 days prior to the start of menstruation, this female should ovulate on day 12 of her cycles. If the cycle starts on March 20 (day 1), then ovulation should occur 12 days later on April 1. **(1 mark)**

Common Errors and Misconceptions:

Since most females normally have a 28 day cycle, many students think that ovulation occurs halfway during the cycle. This is a very common misunderstanding since 14 days prior to the start of a 28 day menstruation is the halfway point. The student text refers only to a 28 day cycle and makes a point that ovulation occurs at the midpoint of the cycle. Which is only true for a 28 day cycle. Teachers should make sure that students understand the difference.

Students should not be penalized for not knowing how many days are in a month.

Concept 2.4: Mitosis

Item Example:
You have been selected to take part in an experiment that involves the administer of a new drug which is suppose to slow the aging process by slowing down or stopping the process of mitosis. Why should you not take part in this experiment.

Answer with Marking Scheme and Explanation: **Value**

The process of mitosis is required throughout the entire life of an individual for growth, maintenance, and repair of the body. **(1 mark)** 2%
If some chemical is taken which interferes with this process, then as expired cells are removed from the body, they will not be replaced. As a result, the individual's body will quickly break down and he/she will die. **(1 mark)**

Common Errors and Misconceptions:
Most students know the steps of mitosis and meiosis and the differences between the two. However, quite often they do not understand the significance of these processes or how it affects growth and development.

Unit 3
Concept 3.1: Dihybrid Cross

Item Example: **Value**
In certain flowers long stem is dominant over short stem and red petals are dominant over white. If two flowers are crossed with both being heterozygous for both traits, what is the probability of the offspring having long stem and white petals? 3%

Answer with Marking Scheme and Explanation:

(L ℓ R r) X (L ℓ R r) **(1 mark)**

	LR	Lr	ℓR	ℓr
LR	LLRR	LLRr	LℓRR	LℓRr
Lr	LLRr	LLrr	LℓRr	Lℓrr
ℓR	LℓRR	LℓRr	ℓℓRR	ℓℓRr
ℓr	LℓRr	Lℓrr	ℓℓRr	ℓℓrr

(1 mark)

The probability of the offspring having long stem and white petals is 3:13
Common Errors and Misconceptions:

When students perform poorly on these type of items it is usually due to doing the gametes or the punnett square incorrectly. Also students often lose marks because they do not answer the question properly. They may give percentage instead of probability or vice versa.

Unit 4
Concept 4.1: Origin of Life

Item Example: **Value**

In the year 3500 AD, CASA(Canadian Aeronautics and Space Association) sent a probe to the outer regions of the galaxy. The probe located a distant planet whose atmosphere contained hydrogen, water vapor, ammonia and methane. Is it plausible that life could eventually evolve? Explain your answer. 2%

Answer with Marking Scheme and Explanation:

According to Oparin-Haldane Theory**,** conditions on this distant planet are similar to theorized condition on Earth which lead to the development of life. 1%

Miller's and Urey's experimental evidence supported the conditions on Earth put forth by Oparin and Haldane. They showed that the conditions on this distant planet were suitable for the development of the molecules of life. 1%

Common Errors and Misconceptions:
This is a typical level 3 item in which students must connect their knowledge of these theories to this question. Although they may have a good knowledge of these theories, they often are not able to connect them to situations such as the ones described in the question. In science, it is essential that teachers provide students opportunities to answer questions at higher levels.are unfamiliar with two aspects of this question.

Concept 4.2: Half Life Calculations

Item Examples:

(i) A rock that is known to be 3.5 billion years old contains 1/32 of the original amount of uranium-235. What is the half-life of uranium-235?

Answer with Marking Scheme and Explanation: **Value**

Students would have to realize that for the rock to have 1/32 of its original amount of uranium-235 then it has gone through 5 half-lifes. **(1 mark)** 2%

So 3.5 billion (3.5×10^9) divided by 5 will give 700 million (7.0×10^8) years for the answer.**(1 mark)**

(ii) A fossil contains 1/16 of the original carbon-14. How old is the fossil if the half-life of carbon-14 is 5730 years?

Value

Students would have to realize that for the rock to have 1/16 of its original amount of carbon-14 then it has gone through 4 half-lifes. **(1 mark)** 2%

So, 5730 years × 4 = 22920. The fossil is 22900 years old.

(ii) What fraction of carbon-14 remains in a fossil that is approximately 17 190 years old? The half-life of carbon-14 is 5730 years.

Value

Students would have to realize that the fossil has decayed through three half-lifes since 17 190 ÷ 5730 = 3. 2%

Three half-lifes means that ½ ×½ ×½ = ⅛. ⅛ of carbon-14 remains.**(1 mark)**

So, 5730 years × 4 = 22920. The fossil is 22900 years old.

Answer with Marking Scheme and Explanation:

Common Errors and Misconceptions:

Many students have difficulty with this concept. They have difficulty converting fractions to half-lifes and vice versa. Students should be given many example problems when doing this topic. Students should also make sure that they follow significant figure rules.

<u>Concept 4.3: Hardy-Weinberg Calculations</u>

These calculations involve the application of two formulae:

$$p + q = 1 \quad \text{and} \quad p^2 + 2pq + q^2 = 1$$

p = frequency of dominant allele
q = frequency of recessive allele
p^2 = frequency of individuals homozygous for dominant allele
2pq = frequency of individuals heterozygous
q^2 = frequency of individuals homozygous for recessive allele
$p^2 + 2pq$ = frequency of individuals expressing dominant trait

Students should be able to express frequencies as percentages or decimals.

Item Examples:

(i) If 16% of a Hardy-Weinberg population expresses a particular recessive trait, calculate the percentage of the population that would have the heterozygous genotype of this trait.

Answer with Marking Scheme and Explanation: **Value**

$q^2 = 16\% = 0.16$ therefore, $q = 0.4$ **(½ mark)** 2%

$p = 1 - q = 1 - 0.4 = 0.6$ **(½ mark)**

$2pq = 2(0.6)(0.4) = 0.48$ **(½ mark)**

The percentage of the population that would have the heterozygous genotype is 48%. **(½ mark)**

(ii) For a population in Hardy-Weinberg equilibrium, the frequency of the recessive allele is 0.3. What percentage of the population is heterozygous?

Answer with Marking Scheme and Explanation: **Value**

$p = 1 - q = 1 - 0.3 = 0.7$ 1%

$2pq = 2(0.7)(0.3) = 0.42$ **(½ mark)**

The percentage of the population that is heterozygous is 42%. **(½ mark)**

(iii) The frequency of a dominant allele for a certain trait in a Hardy-Weinberg population is 0.9. What percentage of individuals would be expected to express the dominant trait?

Answer with Marking Scheme and Explanation: **Value**

$p = 0.9$ therefore, $q = 1 - p = 1 - 0.9 = 0.1$ **(½ mark)** 2%

$2pq = 2(0.9)(0.1) = 0.18$ **(½ mark)**

$p^2 = (0.9)^2 = 0.81$, therefore $p^2 + 2pq = 0.81 + 0.18 = 0.99$ **(½ mark)**

The percentage of individuals that would express the dominant trait is 99%. **(½ mark)**

(iv) If 16% of a Hardy-Weinberg population expresses a recessive trait, what percentage of the population is homozygous for the dominant trait?

Answer with Marking Scheme and Explanation: **Value**

$q^2 = 16\% = 0.16$ therefore, $q = 0.4$ **(½ mark)** 2%

$p = 1 - q = 1 - 0.4 = 0.6$ **(½ mark)**

$p^2 = (0.6)^2 = 0.36$ **(½ mark)**

The percentage of the population that would be homozygous for the dominant trait is 36%. **(½ mark)**

Common Errors and Misconceptions:

Many students have difficulty with this concept. They often get confused with allele frequency and genotype or phenotype frequency. Students should be given many example problems when doing this topic.