Biology 30 Year-End Review Booklet

The Biology 30 Diploma Examination consists of 48 multiple-choice questions and 12 numerical-response questions worth one mark each. Multiple choice questions are worth one mark each and require you to select the best answer. There is no penalty for guessing—never leave a blank on your answer sheet. Numerical-response questions are worth one mark each and require you to fill in the correct sequence of numbers on your answer sheet.

Read the instructions, then read the context and the question or questions you will be answering. Carefully read all the information given in the context provided. For multiple-choice questions, read the stem of the question and formulate an answer to the question in your mind before looking at the four alternatives given. Then look at the four alternatives and find the answer among them. Some questions are more difficult than others and will require you to choose the *best* answer. For numerical-response questions, pay close attention to the instructions below the question so that your answers are expressed or rounded appropriately with the correct number of digits.

The examination is 2.5 hours in length. Budget about 2 minutes 20 seconds per question, and this should leave about 10 minutes at the end to revise and double check your work before handing it in. Mark questions that you can't answer immediately and come back to them later. Pace yourself and answer every question.

Breakdown of the examination:

Unit A = Nervous and Endocrine Systems = 25%
Unit B = Reproduction and Development = 20%
Unit C = Cell Division, Genetics and Molecular Biology = 40%
Unit D = Population Genetics = 15%

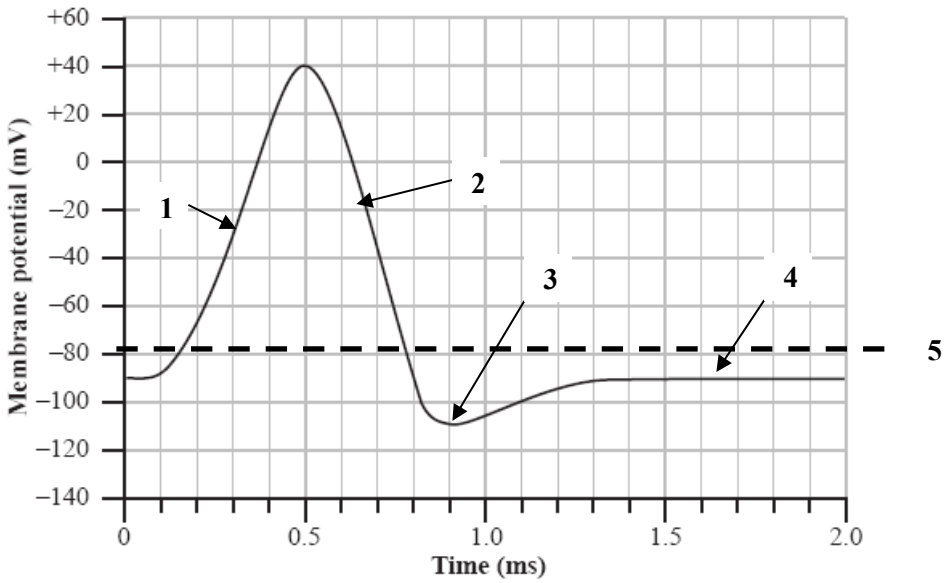
Here are some practice questions representative of a diploma examination.

1. Stimulation of an individual's sympathetic nervous system in response to imminent danger leads to all of the following responses except

A. dilation of the pupils of the eyes
B. constriction of the bronchioles of the lungs
C. constriction of the arterioles of the intestines
D. dilation of the arterioles of the skeletal muscles

Use the following information to answer the next three questions.

The graph below illustrates the membrane potential of a normal neuron after stimulation.



2. *The threshold potential is indicated by* ____***i***____ *on the diagram above, and a true statement about the threshold potential is* ____***ii***____.

The statement above is completed by the information in row

Row	*i*	*ii*
A.	**1**	it is the same electrical potential for all neurons
B.	**5**	it is the depolarization required to generate an action potential
C.	**1**	it determines the time it takes for an action potential to be completed
D.	**5**	it determines the time it takes for an impulse to travel along the axon

Numerical Response

1. Match the events on the diagram of the action potential above with the description below.

Answer: _____ _____ _____ _____

Depolarization **Resting potential** **Hyperpolarization** **Repolarization**

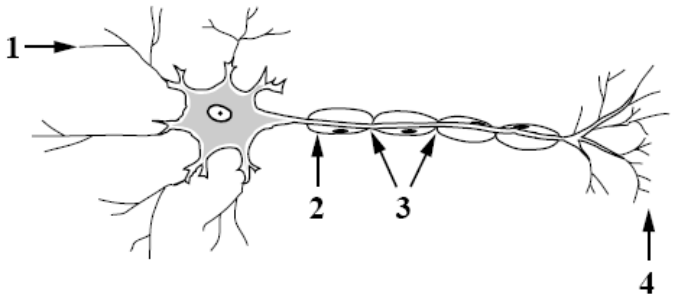
(Record your **four-digit answer** in the numerical-response section of the answer sheet.)

3. Relative to inside of a neuron, the extracellular fluid immediately outside a resting neuron's cell membrane is

A. positive and the sodium ion concentration is less
B. negative and the sodium ion concentration is less
C. positive and the sodium ion concentration is greater
D. negative and the sodium ion concentration is greater

Use the following information to answer the next question.

A Motor Neuron



4. If the structures labeled **2** were absent, what effect on neural transmission would be expected?

A. The axon would not release acetylcholine.
B. The axon would be not become depolarized.
C. The speed of transmission would be reduced.
D. Cholinesterase would not be secreted to deactivate acetylcholine.

Numerical Response

2. Match the number of the appropriate structure on the diagram of the neuron above with its function below.

Answer: _____ _____ _____ _____

release transmitter chemical	**conduct nerve impulses toward the cell body**	**prevent charge loss**	**allow saltatory conduction of impulses**

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

Use the following information to answer the next question.

Individuals know that touching a hot stove can be painful. When an individual accidentally touches a hot stove, a reflex arc is initiated, which causes the person to withdraw his or her hand before he or she senses the pain.

5. Which of the following lists identifies the neural pathway in a reflex arc?

A. Receptor, sensory neuron, effector, motor neuron
B. Motor neuron, interneuron, sensory neuron, effector
C. Sensory neuron, receptor, interneuron, motor neuron
D. Receptor, sensory neuron, interneuron, motor neuron

Use the following information to answer the next two questions.

Processes That Occur at a Neuromuscular Junction (A Type of Synapse)

1	Muscle fibres contract when sodium gates open allowing sodium ions to diffuse into the muscle cytoplasm.
2	Acetylcholine is released from the axon terminal.
3	Acetylcholine binds to the receptors on the muscle cell.
4	Cholinesterase breaks down acetylcholine, and the sodium gates close.

Numerical Response

3. An impulse arrives at an axon terminal that synapses with a muscle cell. Record the processes in the order that they occur at the synapse.

Answer: _____

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

6. Certain chemicals inhibit cholinesterase at neuromuscular junctions. The resulting muscular spasms occur because of the

A. depletion of cholinesterase in the presynaptic neuron
B. depletion of acetylcholine in the neuromuscular junction
C. accumulation of cholinesterase in the presynaptic neuron
D. accumulation of acetylcholine in the neuromuscular junction

Use the following information to answer the next question.

Huntington Disease

Many genetic disorders in humans result in some behavioural abnormality. One example is Huntington disease (HD), which is controlled by the presence of a dominant gene. This disease affects all parts of the nervous system, including the brain. Symptoms of HD usually appear after age 40 and include a gradual loss of motor function and coordination. Degeneration of the nervous system is progressive and produces personality changes. Affected individuals become unable to care for themselves. These symptoms indicate that the disease affects some parts of the brain more than others.

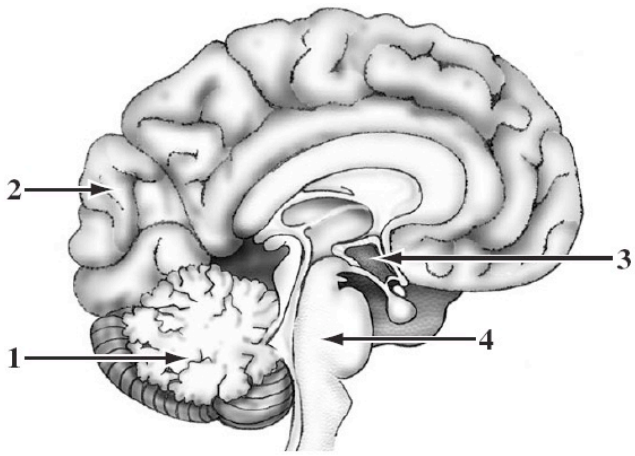
7. Which row identifies the degree to which certain parts of the brain are most likely affected by HD?

Row	Relative Effects of HD on Parts of the Body			
	Cerebrum	**Cerebellum**	**Pituitary**	**Hypothalamus**
A.	slight	slight	significant	significant
B.	significant	slight	significant	slight
C.	slight	significant	slight	significant
D.	significant	significant	slight	slight

Use the following information to answer the next two questions.

Individuals with Refsum disease cannot metabolize phytanic acid, which results in a buildup of phytanic acid in body tissues and impairs the development of the myelin sheath on neurons. Symptoms of Refsum disease include hearing and vision loss, decreased muscle coordination, and a reduced sense of smell.

Human Brain



8. In the diagram above, two areas of the brain whose function can be affected in a person with Refsum disease are numbered

A. 1 and 2
B. 1 and 4
C. 2 and 3
D. 3 and 4

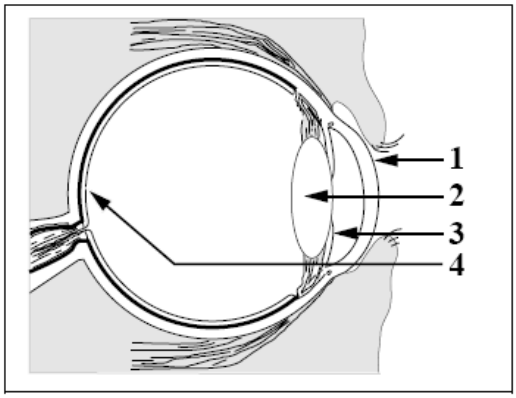
9. Symptoms of vision loss in individuals with Refsum disease include cataracts and impaired night vision. Which of the following rows identifies the structure of the eye that is affected by cataracts and the cells that, when damaged, result in night vision loss?

Row	Cataracts	Night Vision Loss
A.	Retina	Rod cells
B.	Lens	Cone cells
C.	Lens	Rod cells
D.	Retina	Cone cells

Use the following information to answer the next question.

Many blind people have damaged sensory receptors in the eyes but undamaged optic nerves.

The Human Eye



10. To assist these people, an artificial eye would have to replace the function of which structure in the diagram?

A. 1
B. 2
C. 3
D. 4

Use the following information to answer the next question.

Structures of Sensory Perception

1	Optic nerve
2	Proprioceptor
3	Photoreceptor
4	Occipital lobe
5	Temporal lobe
6	Auditory nerve

Numerical Response

4. After light enters the eye, the structures of sensory perception listed above that are stimulated are _____, _____, and _____.

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

Use the following information to answer the next question.

Damage to hair cells in the inner ear was thought to permanently impair the sense of balance. Recent research indicates that humans and guinea pigs have the ability to form new hair cells in the utricle. In experiments, these hair cells were chemically destroyed. After some time, new hair cells formed. These new cells eventually connected with neurons. Researchers have yet to discover the internal body stimuli that trigger the formation of the new cells.

11. In order to develop a procedure that would restore hearing in individuals with hearing loss caused by damage to hair cells, similar research must be done on the hair cells found in the

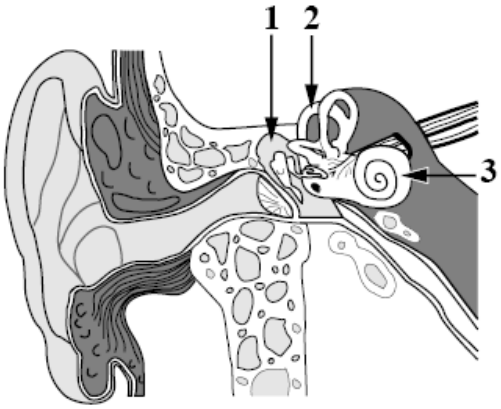
A. saccule
B. cochlea
C. auditory canal
D. semicircular canals

12. Which sequence correctly shows the path of sound transmission in the ear?

A. Auditory canal → tympanic membrane → ossicles → organ of Corti
B. Auditory canal → ossicles → tympanic membrane → organ of Corti
C. Tympanic membrane → eustachian tube → semicircular canals → cochlea
D. Tympanic membrane → semicircular canals → eustachian tube → cochlea

Use the following diagram to answer the next question.

The Human Ear



13. Which row correctly identifies the state of the matter normally contained within structures 1, 2, and 3?

Row	Structure 1	Structure 2	Structure 3
A	gas	solid	solid
B	liquid	liquid	solid
C	liquid	solid	liquid
D	gas	liquid	liquid

Use the following information to answer the next two questions.

In a research study, the pancreas was removed from six rhesus monkeys. Pancreatic cells from unrelated donors were then transplanted into the livers of these monkeys. Four of the monkeys received injections of a drug that blocks immune system rejection of foreign cells.

The transplanted pancreatic cells in the monkeys that received the injections were not rejected by the monkeys' immune systems, and the cells began secreting insulin. The transplanted pancreatic cells in the two monkeys that were not given the injections were rejected.

14. The manipulated variable in the study above is the

A. group of monkeys that did not receive the drug
B. administration of the drug to the monkeys
C. species of monkey used in the experiment
D. rejection of the transplanted cells

15. Besides affecting insulin secretion, removal of the pancreas directly affects the secretion of

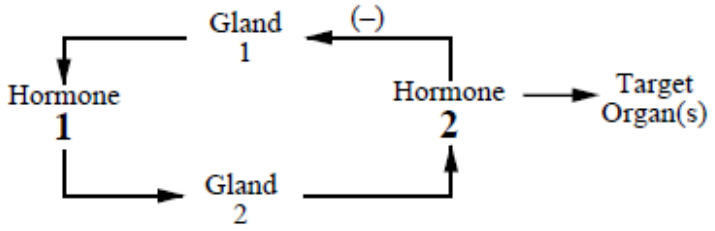
A. aldosterone
B. glucagons
C. glycogen
D. cortisol

16. Which sequence illustrates a mechanism used by the body to control the blood glucose level?

A. Blood glucose increases → release of glucagon increases → conversion of glycogen into glucose decreases → blood glucose decreases
B. Blood glucose decreases → release of glucagon decreases → conversion of glycogen into glucose decreases → blood glucose increases
C. Blood glucose increases → release of insulin increases → conversion of glucose into glycogen increases → blood glucose decreases
D. Blood glucose decreases → release of insulin decreases → conversion of glucose into glycogen increases → blood glucose increases

Use the following information to answer the next question.

Control of the Secretion of Hormone 1 and Hormone 2



17. If Gland 1 is the pituitary gland, the row that identifies Hormone 1, Gland 2, and Hormone 2 is

Row	Hormone 1	Gland 2	Hormone 2
A.	FSH	testes	testosterone
B.	TSH	thyroid	thyroxine
C.	FSH	ovaries	progesterone
D.	ADH	kidney	aldosterone

Use the following information to answer the next question.

Some Functions of Hormones

1 Promote muscle and bone development
2 Increase water reabsorption in the kidneys
3 Increase the level of amino acids in blood plasma
4 Stimulate the conversion of glucose into glycogen

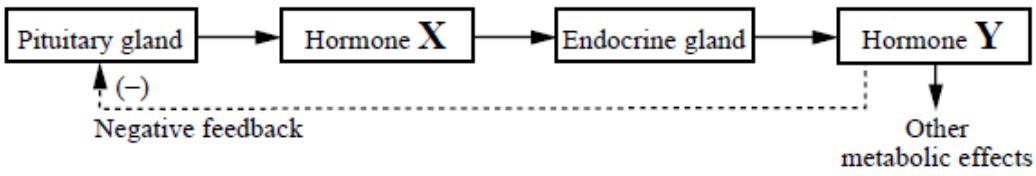
Numerical Response

5. Identify the main function of each hormone named below.

ADH _____ (Record in column 1 on the answer sheet)
Cortisol _____ (Record in column 2 on the answer sheet)
hGH _____ (Record in column 3 on the answer sheet)
Insulin _____ (Record in column 4 on the answer sheet)

Use the following information to answer the next question.

Control of the Secretion of Hormone Y by the Pituitary Gland



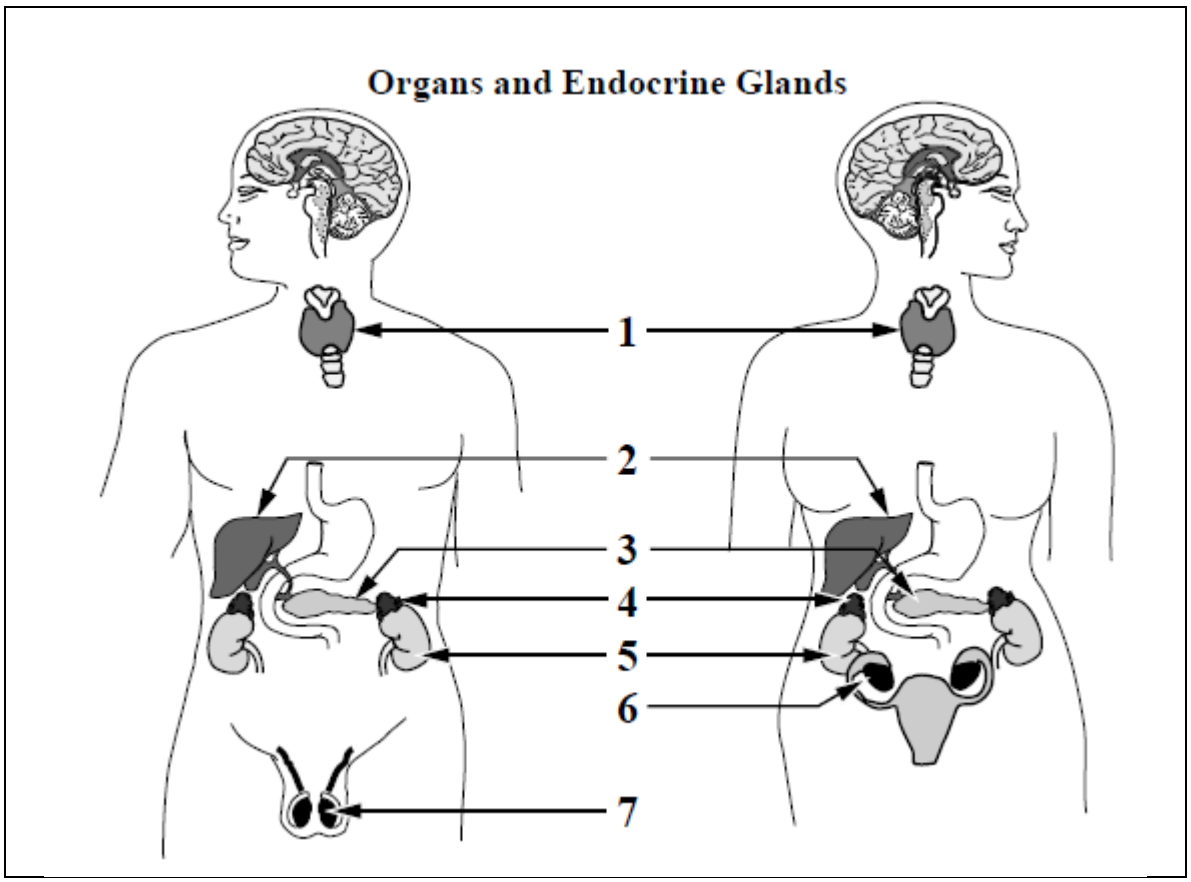
18. Normally, inhibition of the pituitary gland would occur if the secretion of hormone X

A. increased, causing a decrease in the secretion of hormone Y
B. decreased, causing a decrease in the secretion of hormone Y
C. increased, causing an increase in the secretion of hormone Y
D. decreased, causing an increase in the secretion of hormone Y

19. Which of the following rows identifies the source of cortisol, the hormone that stimulates the release of cortisol, and an effect of cortisol?

Row	Source	Hormone	Effect
A.	Adrenal gland	ACTH	Increased conversion of amino acids to glucose
B.	Pituitary gland	ACTH	Increased protein synthesis
C.	Adrenal gland	ADH	Increased conversion of glycogen to glucose
D.	Pituitary gland	ADH	Increased water reaborption

Use the following information to answer the next question.



Numerical Response

6. Match the number of the appropriate structure on the diagram of endocrine organs and glands above with its function below.

Answer: _____ _____ _____ _____

releases hormones to stimulate female secondary sex characteristics	**releases antagonistic hormones to control calcium balance**	**releases antagonistic hormones to control glucose balance**	**stimulated by the nervous system to release hormones in short-term stress**

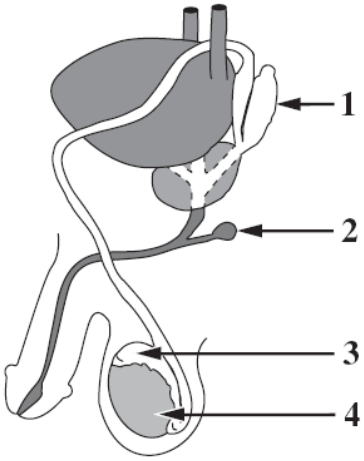
(Record your **four-digit answer** in the numerical-response section of the answer sheet.)

20. A characteristic symptom of hyperthyroidism is

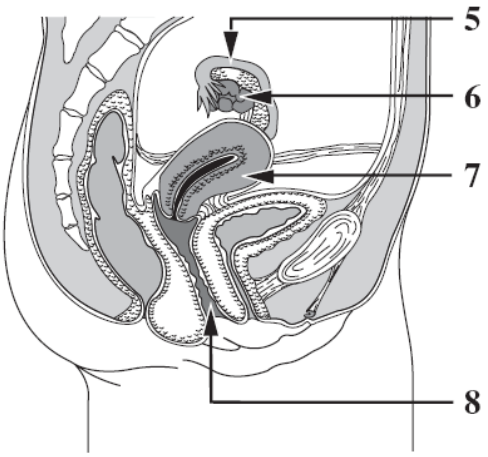
A. lethargy
B. weight loss
C. intolerance to cold
D. slowed mental processes

Use the following information to answer the next two questions.

Male Reproductive System



Female Reproductive System



Numerical Response

7. Match four of the structures of the male and female reproductive systems numbered above with the appropriate descriptions, as given below.

Structure: _____ _____ _____ _____

Site of spermatogenesis	**Site of oogenesis**	**Site of production of fructose fluid, which makes up a portion of semen**	**Usual site of the first mitotic division after fertilization**

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

Use the following information to answer the next question.

Functions of the Four Main Reproductive Hormones in Human Males

1	Stimulation of puberty and release of gonadotropic hormones
2	Stimulation of testosterone production by the testes
3	Stimulation of the development of secondary sex characteristics and sex drive
4	Stimulation of sperm development

Numerical Response

8. Identify the major function, as numbered above, of each of the hormones given below.

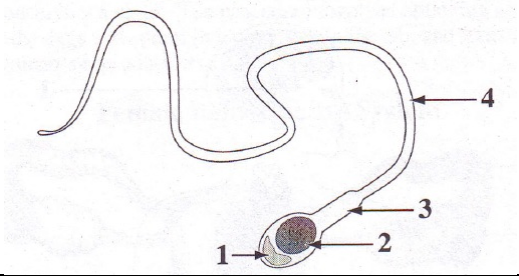
Function: _____ _____ _____ _____

Hormone: **FSH** **LH** **Testosterone** **GnRH**

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

Use the following information to answer the next question.

Human Sperm Cell

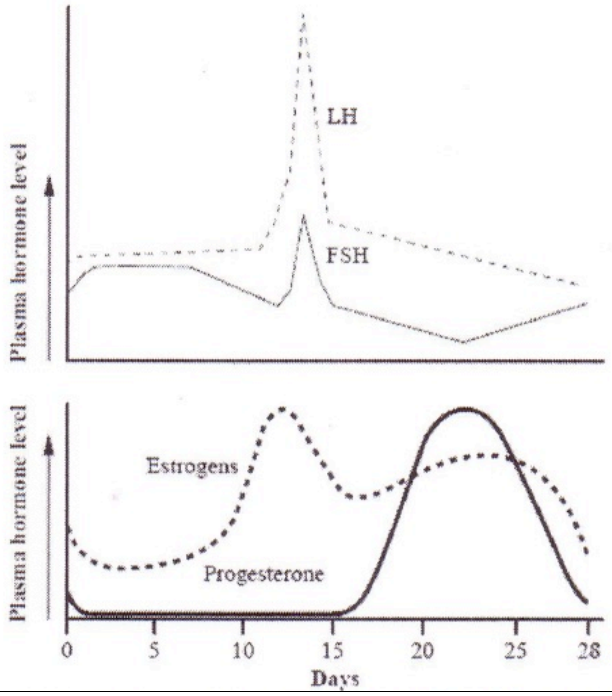


21. The row that correctly identifies the structure and its function for the sperm cell is

Row	Structure	Function
A.	**1**	contains enzymes to dissolve the egg coating during fertilization
B.	**2**	propels the sperm from site of ejaculation towards the egg
C.	**3**	contains genetic material of the cell
D.	**4**	contains organelles that provide energy for the sperm to swim

Use the following information to answer the next two questions.

Changing Levels of Hormones During the Menstrual Cycle



22. The rise in LH occurring in the middle of the menstrual cycle is most closely linked to

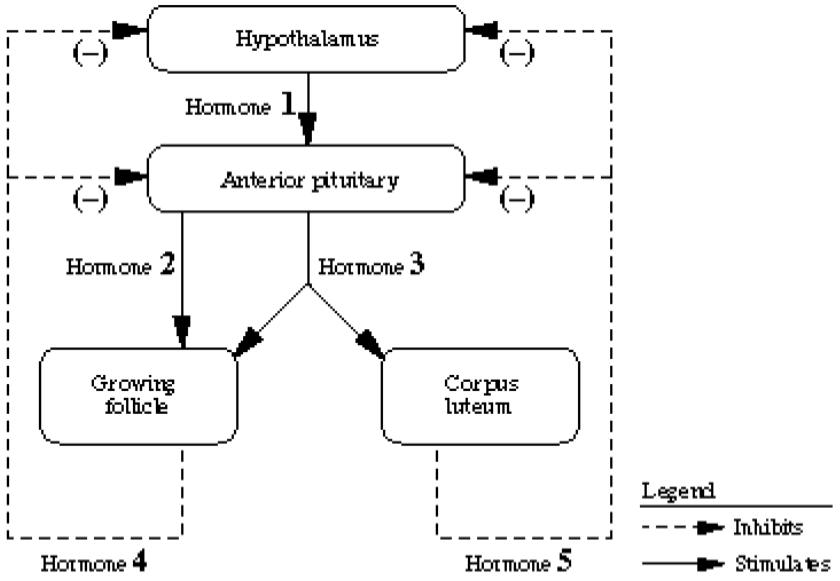
A. development of secondary sex characteristics
B. maintenance of the endometrium
C. follicle development
D. ovulation

23. The rise in estrogen and progesterone in the latter half of the menstrual cycle is due to

A. secretion by the corpus luteum
B. secretion by the ovarian follicle
C. secretion by the pituitary gland
D. secretion by the hypothalamus

Use the following information to answer the next question.

Regulation of Reproductive Hormone Secretion



24. Which row correctly identifies hormones 2, 3, 4, and 5?

Row	Hormone 2	Hormone 3	Hormone 4	Hormone 5
A.	LH	FSH	progesterone	estrogen
B.	LH	FSH	estrogen	progesterone
C.	FSH	LH	progesterone	estrogen
D.	FSH	LH	estrogen	progesterone

Use the following information to answer the next question.

Some Events in Early Human Development

1 the nucleus of a sperm joins with the nucleus of the egg
2 the fertilized zygote divides (mitosis) with no growth in size
3 the egg is released from the ovary as the follicle ruptures
4 enzymes released by sperm acrosomes digest the jelly coat of the egg

Numerical Response

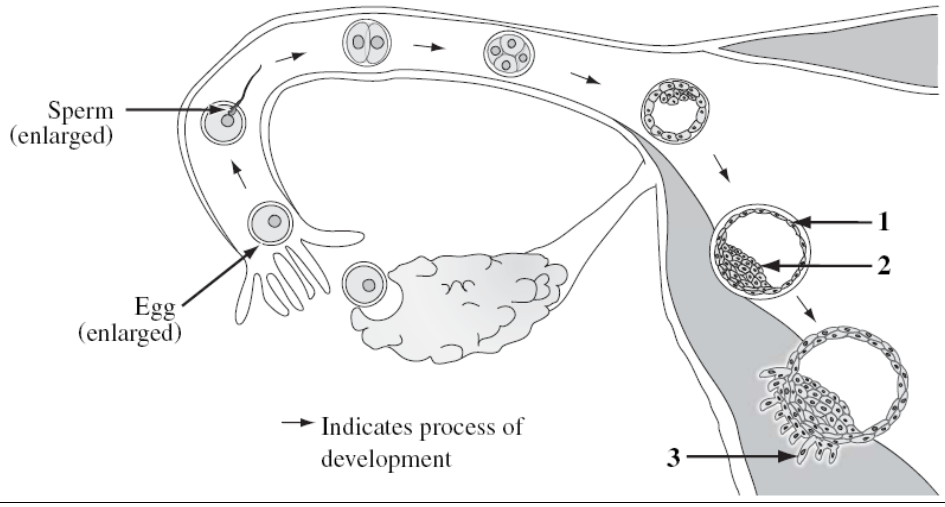
9. The sequence of the above events that occurs during early human development is

Answer: _____ _____ _____ _____

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

Use the following diagram to answer the next question.

Some Events That Occur During and After Fertilization



25. Which of the following rows identifies structure **3** and the structure it becomes part of?

Row	Structure 3	Structure It Becomes Part of
A.	Chorion	Placenta
B.	Amnion	Chorion
C.	Placenta	Amnion
D.	Placenta	Chorion

Use the following information to answer the next question.

Some Organs and Tissues that Develop in an Embryo

1	Lining of digestive tract
2	Brain and outer layer of skin
3	Muscle and blood

Numerical Response

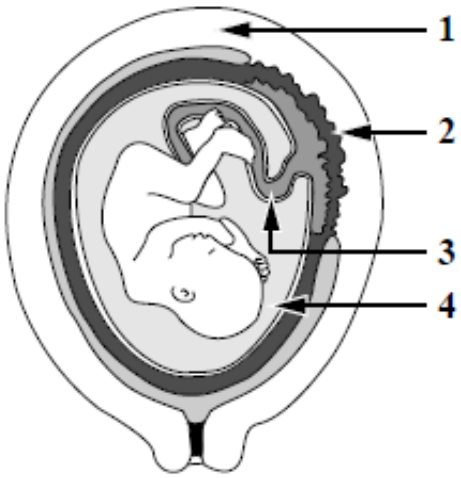
10. Match the organs and tissues listed above with the germ layer from which they develop, as indicated below.

Organs and Tissues: _____ _____ _____
Germ Layer: Endoderm Mesoderm Ectoderm

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

Use the following information to answer the next question.

The Developing Fetus and Associated Structures



26. Doctors use a procedure called amniocentesis in which a needle is used to sample cells from the amniotic fluid then test the cells for any chromosomal abnormalities in the fetus. The structure that fluid is taken from is

A. 1
B. 2
C. 3
D. 4

Use the following information to answer the next question.

In the late 1950s and early 1960s, the drug thalidomide was prescribed to pregnant women to combat morning sickness. Thalidomide was found to cause birth defects, such as stunted growth of the arms and legs.

27. Which of the following rows identifies the classification of thalidomide as a factor affecting fetal development and the trimester during which exposure to thalidomide would have the **greatest** effect on a fetus?

Row	Classification	Trimester
A.	Genetic	First
B.	Environmental	First
C.	Genetic	Second
D.	Environmental	Second

Use the following information to answer the next question.

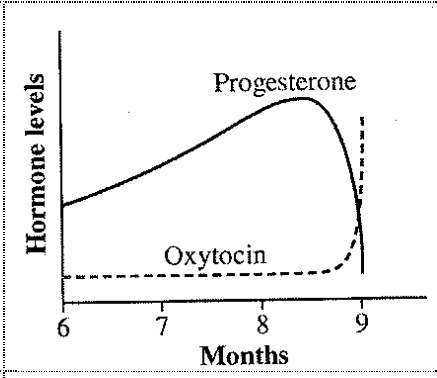
A young woman's first two pregnancies ended in miscarriages in the second trimester. She is now pregnant for a third time and is seeking help to avoid another second-trimester miscarriage.

28. The row that best identifies a possible cause of this woman's previous miscarriages, a procedure that could be used to detect the cause, and a treatment that could be used to help avoid another second-trimester miscarriage is

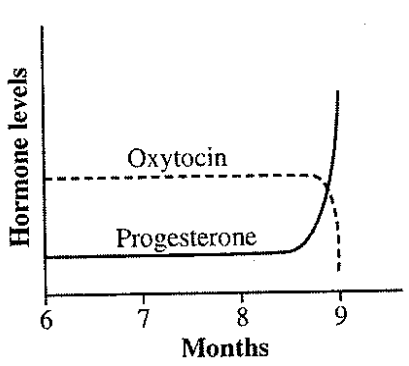
Row	Cause	Procedure	Treatment
A.	Low levels of estrogen and progesterone	Blood analysis	Hormone therapy
B.	Failure of the blastocyst to implant	Ultrasound imaging	Caesarean section
C.	Blocked Fallopian tubes	Amniocentesis	*In vitro* fertilization
D.	Scarring inside the endometrium	Ultrasound imaging	Hormone therapy

29. Which of the following graphs best illustrates the relative levels of oxytocin and progesterone in a woman during pregnancy?

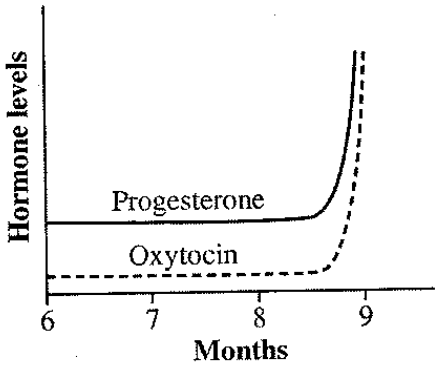
A.



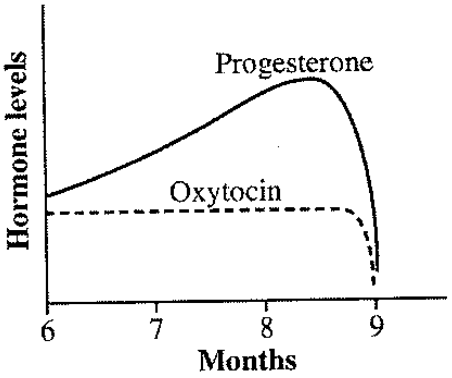
B.



C.



D.



30. Beginning with the stage in which DNA replicates itself, the correct sequence of stages in the cell cycle is

A. synthesis, G1, G2, mitosis
B. mitosis, G1, synthesis, G2
C. synthesis, G2, mitosis, G1
D. mitosis, G2, G1, synthesis

31. During mitosis, the chromosomes

A. are located at the cell equator during prophase
B. are located at the cell equator during telophase
C. move toward the poles of the cell during anaphase
D. move toward the poles of the cell during metaphase

32. Mitosis results in

A. genetic variation and cell divisions
B. cell divisions and genetic continuity
C. gamete formation and genetic variation
D. genetic continuity and gamete formation

Use the following information to answer the next question.

Some Events that Occur During Meiosis

1 Gametes are produced.
2 Spindles form and homologous pairs of chromosomes separate.
3 Centromeres divide and chromatid pairs separate.
4 Chromosomes are replicated.

Numerical Response

11. Provide the correct sequence of these four events that occur during meiosis.

Answer: _____

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

33. The process that occurs to form an eight-cell embryo from a zygote is

A. mitosis of diploid cells
B. mitosis of haploid cells
C. meiosis of diploid cells
D. meiosis of haploid cells

Use the following information to answer the next question.

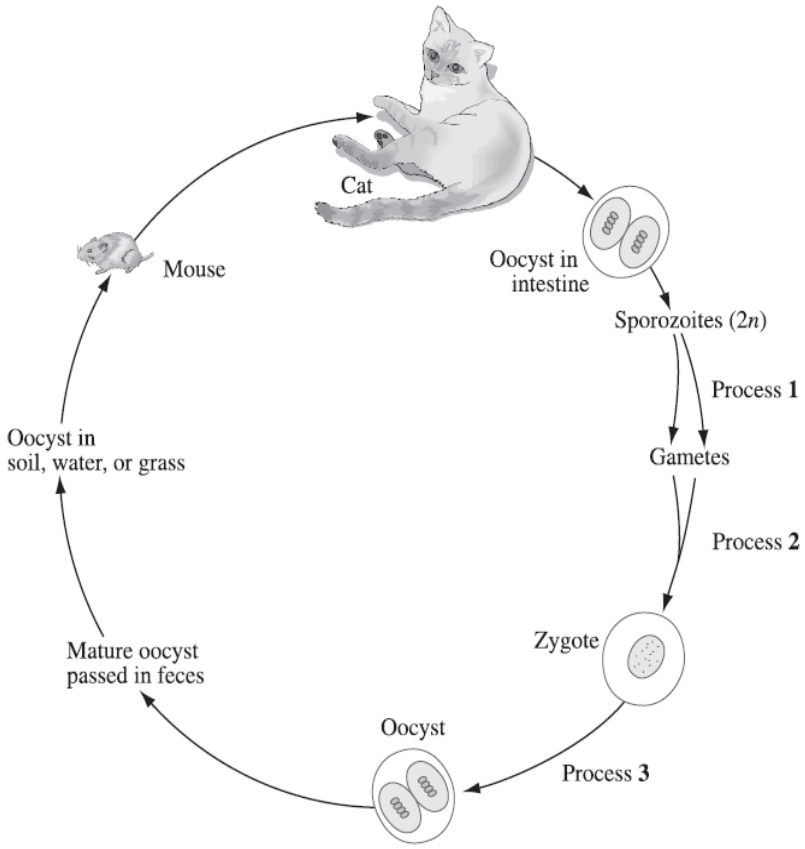
Two X chromosomes in a female have the ability to exchange more segments of DNA than the X and Y chromosomes in a male. This limit to recombination prevents the loss of certain genes from the Y chromosome.

34. The exchange of DNA segments occurs as a result of

A. crossing over in Prophase I
B. crossing over in Prophase II
C. nondisjunction in Prophase I
D. nondisjunction in Prophase II

Use the following information to answer the next two questions.

Life Cycle of *Toxoplasma gondii*



35. Which of the following rows identifies process 1 and process 3 in the life cycle shown above?

Row	Process 1	Process 3
A.	Mitosis	Mitosis
B.	Mitosis	Meiosis
C.	Meiosis	Meiosis
D.	Meiosis	Mitosis

36. The haploid structure in the life cycle of *Toxoplasma gondii* is the

A. zygote
B. oocyst
C. gamete
D. sporozoite

Use the following information to answer the next question.

Events That Occur During DNA Replication (Arranged in Random Order)

1	Hydrogen bonds form between nucleotide bases.
2	An enzyme acts like a pair of scissors to break the weak hydrogen bonds between the nitrogen bases.
3	At the replication fork, the DNA template strands determine the sequence of the nucleotides that are being replaced.
4	A purine or pyrimidine is inserted on a matching nucleotide of the polynucleotide strand.
5	Nitrogen bases of the polynucleotide strand separate.

37. The correct sequence of events that occurs during DNA replication is

A. 2, 3, 5, 1, and 4
B. 2, 5, 3, 4, and 1
C. 3, 2, 5, 4, and 1
D. 3, 5, 2, 1, and 4

38. If guanine and cytosine make up 56% of the nitrogen bases present in a DNA molecule, what percentage of the DNA's nitrogen bases are made up of adenine?

A. 44%
B. 28%
C. 25%
D. 22%

39. Mitochondrial DNA and nuclear DNA both code for the formation of proteins. Which of the following statements about protein synthesis is **true**?

A. An mRNA anticodon binds with an amino acid codon, which results in the placement of a specific tRNA molecule in the polypeptide chain.
B. An mRNA anticodon binds with a tRNA codon, which results in the placement of a specific polypeptide molecule in the amino acid chain.
C. A tRNA anticodon binds with an mRNA codon, which results in the placement of a specific amino acid molecule in the polypeptide chain.
D. A tRNA anticodon binds with a polypeptide codon, which results in the placement of a specific mRNA molecule in the amino acid chain.

Use the following information to answer the next question.

Amino Acid Sequence in Insulin

Dr. Frederick Sanger and his colleagues in England worked out the exact sequence of 51 amino acids in the insulin molecule. One part of that sequence of amino acids is:

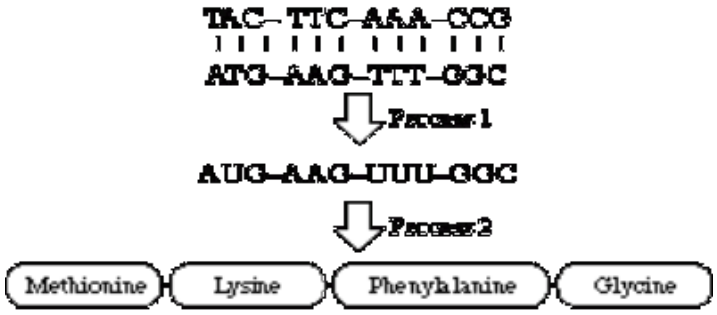
— alanine — lysine — proline — threonine —

40. Which sequence of nitrogen bases in DNA encodes information to make this part of the insulin molecule?

A. CGA — TTT — GGT — TGA —
B. CGT — AAA — GGT — ACT —
C. GCU — AAA — CCA — ACU —
D. GCG — AAG — CCA — ACG —

Use the following information to answer the next question.

Cellular Processes



41. Which row correctly identifies Processes 1 and 2 and indicates the locations in which these processes occur?

Row	Process 1	Process 2
A.	transcription—nucleus	translation—cytoplasm
B.	translation—cytoplasm	transcription—nucleus
C.	translation—nucleus	transcription—cytoplasm
D.	transcription—cytoplasm	translation—nucleus

Use the following information to answer the next question.

Some Steps in Gel Electrophoresis

1 An electric current is passed through a gel medium.
2 DNA samples are injected into the wells of a gel.
3 DNA from an individual's somatic cells is cut using specific restriction enzymes.
4 DNA sequences are separated into bands based on molecular weight.

Numerical Response

12. The sequence of steps above, listed in the order in which they occur in gel electrophoresis is _____, _____, _____, and _____.

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

Use the following information to answer the next two questions.

Tay-Sachs disease is a hereditary disease that kills 1 in 360 000 individuals in the general population. Children who are homozygous for Tay-Sachs disease die at an early age. Genetic screening can be done to determine if an individual is a carrier of the Tay-Sachs allele.

42. What type of inheritance is demonstrated in Tay-Sachs disease?

A. Autosomal recessive
B. Autosomal dominant
C. Sex-linked recessive
D. Sex-linked dominant

Use the following additional information to answer the next question.

Genetic screening can involve producing complementary DNA probes of a gene's alleles and determining if these bind to an individual's DNA sample.

43. Genetic screening results show that an individual is a carrier of Tay-Sachs disease if the individual's DNA binds to

A. none of the DNA probes
B. two of the normal allele DNA probes
C. two of the defective allele DNA probes
D. one of the normal allele DNA probes and one of the defective allele DNA probes

Use the following information to answer the next question.

The coat colour of Labrador retrievers is determined by two alleles. The black allele, *B*, is dominant to the brown allele, *b*. A second pair of alleles, *E* and *e*, affects the expression of the coat colour: the homozygous recessive condition, *ee*, prevents the expression of black or brown and produces a pup with a yellow coat.

Genotype	**Phenotype**
B _ E _	Black
bbE _	Brown
_ _ ee	Yellow

Numerical Response

13. If two Labrador retrievers with the genotype *BbEe* were to be crossed, what phenotypic ratio would be expected in their offspring?

Ratio: _____ : _____ : _____
Phenotype: Black Brown Yellow

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

Use the following information to answer the next question.

Hypophosphatemic rickets is an X-linked dominant disorder that is characterized by abnormal growth and bone formation.

Numerical Response

14. If a man who is affected with hypophosphatemic rickets and a woman who is heterozygous for the disorder have a child, what is the probability that the child will be a daughter who is heterozygous for the disorder?

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.)

Use the following information to answer the next question.

Blood is typed on the basis of various factors found both in the plasma and on the red blood cells. A single pair of codominant alleles determines the M, N, and MN blood groups. ABO blood type is determined by three alleles: the I^A and I^B alleles, which are codominant, and the *i* allele, which is recessive. There are four distinct ABO blood types: A, B, AB, and O.

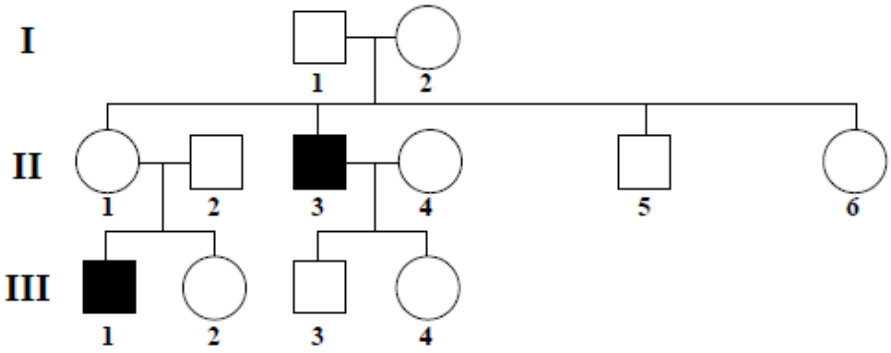
44. A man has type MN and type O blood, and a woman has type N and type AB blood. What is the probability that their child has type N and type B blood?

A. 0.00
B. 0.25
C. 0.50
D. 0.75

Use the following information to answer the next question.

Hypohidrotic ectodermal dysplasia is a rare genetic disease that causes problems with most embryonic ectoderm development, but does not usually affect the nervous system. Individuals are born apparently healthy but lack sweat glands.

A Pedigree for a Family Affected by Hypohidrotic Ectodermal Dysplasia



Note: Carriers have not been identified and all marriage partners are known to be unrelated.

—from *Discover*

45. Which individuals from the pedigree are **definitely** carriers of the disease?

A. I-1 and II-5
B. I-2 and II-1
C. III-1 and III-4
D. III-2 and III-4

Use the following information to answer the next question.

The characteristics plexus wings, scabrous eyes, speckled body, and brown eyes are influenced by genes found on chromosome 2 of the common fruit fly, *Drosophila melanogaster*. Crossover frequencies between the genes are given in the following table.

Genes	Crossover frequency
Speckled body (**3**) and scabrous eyes (**2**)	41%
Brown eyes (**4**) and plexus wings (**1**)	4%
Plexus wings (**1**) and scabrous eyes (**2**)	34%
Speckled body (**3**) and brown eyes (**4**)	3%

Numerical Response

15. Using the numbers above, construct a map showing the correct order of the genes on chromosome 2 in the fruit fly.

Answer: _____

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

Use the following information to answer the next two questions.

The Ancon sheep has unusually short legs, which is an autosomal recessive trait. Through progressive inbreeding of this strain of sheep, New England farmers were able to produce sheep that are too short to jump the walls that enclose pastures.

46. Establishing a population of short-legged sheep from a single sheep that has short legs illustrates the concept of

A. gene flow
B. succession
C. genetic drift
D. non-random mating

Numerical Response

16. If 36 sheep in a flock of 100 are Ancon sheep, then how many of the sheep in the flock can be expected to be heterozygous for the Ancon trait?

Answer: _____

(Record your **answer as a whole number** in the numerical-response section on the answer sheet.)

Use the following information to answer the next two questions.

The Arctic National Wildlife Refuge in Alaska is home to many species of arctic animals, including the Porcupine caribou herd. The calving grounds of the caribou constitute an area of 360 000 hectares in the wildlife refuge. The population of the Porcupine caribou on the calving grounds decreased from 178 000 in 1989 to 129 000 in 2001.

Numerical Response

17. What was the population density of the Porcupine caribou herd on the calving grounds of the Arctic National Wildlife Refuge during the calving season of 2001?

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.)

47. What was the per capita growth rate of the Porcupine caribou herd between 1989 and 2001?

A. +0.38
B. +0.28
C. –0.28
D. –0.38

Use the following information to answer the next three questions.

Wood bison are the largest land animals in North America. They were a major food source for people of the First Nations. In the 1650s, an estimated 168 000 bison roamed northern Alberta, northeastern British Columbia, and the Northwest Territories. By 1891, only 250 bison were left in these regions.

48. Prior to the 1650s, the wood bison population in North America remained close to the carrying capacity of its habitat. The generalized growth curve and the reproductive strategy of the wood bison were, respectively,

A. a J-curve and *r* selection
B. a J-curve and *K* selection
C. an S-curve and *r* selection
D. an S-curve and *K* selection

49. Hunting of the bison for meat and hides by First Nations people helped maintain the bison population near the carrying capacity of its habitat by increasing the

A. natality of the bison
B. intraspecific competition
C. environmental resistance
D. biotic potential of the bison

Use the following additional information to answer the next question.

Some Relationships Between Wood Bison and Other Species

1 Elk and deer compete with wood bison for food and living space.
2 Many wood bison are infected with tuberculosis or brucellosis bacteria.
3 Smaller wood bison compete with larger wood bison for food and living space.
4 Grazing by wood bison provides more suitable digging conditions for prairie dogs.

Numerical Response

18. Match each of the relationships numbered above with its classification, as given below.

Relationship:	_____	_____	_____	_____
Classification:	**Parasitism**	**Commensalism**	**Interspecific competition**	**Intraspecific competition**

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

Use the following additional information to answer the next question.

Characteristics of Komodo Dragons

1 Classified as reptiles
2 Can live up to 30 years
3 Females lay between 20 and 30 eggs per year
4 Sexually mature at about six years of age
5 Females mate once a year
6 Over three metres in length and weigh up to 70 kg
7 The young live in trees until they are one year old
8 Adult Komodo dragons will eat young Komodo dragons

Numerical Response

19. Four characteristics of Komodo dragons that allow scientists to classify them as relatively K-selected strategists are _____, _____, _____, and _____.

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

Use the following information to answer the next two questions.

In heavily populated regions of Canada, the landscape is now dominated by what scientists call "invasive" non-native species. Horticultural expert Bill Granger has described the Norway maple as a "tree on steroids" because of its dense rooting system. This tree reaches sexual maturity quickly and spreads many seeds over a wide area. Another invasive species, pampas grass, is described by Dr. Spencer Barrett as an "excellent opportunist." Pampas grass relies on allies such as humans to cut out vegetative competition before it proceeds to dominate the landscape.

50. By maintaining a stronghold on the environment and preventing further environmental changes, the Norway maple could be described as

A. a climax species
B. a pioneer species
C. a seral stage species
D. an intermediate species

51. Two strategies that give the Norway maple a high biotic potential are identified in row

Row	Strategy 1	Strategy 2
A.	is on steroids	reaches sexual maturity early
B.	reaches sexual maturity early	has large number of seeds
C.	spreads seeds over a large area	is on steroids
D.	spreads seeds over a large area	has strong root system

Use the following information to answer the next four questions.

In Canada, to manage the harvest of fish, government departments issue quotas based on population estimates. Problems in salmon and cod fisheries have drawn attention to problems in the calculation of the estimates. Quotas based on these estimates have led to overharvesting and have driven the cod fishery into disaster.

52. The carrying capacity for northern cod in Canada's Atlantic region may be described as the

A. harvest quota that permits sustainable yield
B. harvest quota that matches the natural mortality of the cod
C. decline on a growth curve that shows the population size dropping
D. plateau on a growth curve that shows the population size has reached a limit

You have now completed the examination.
You may wish to review and revise your answers.