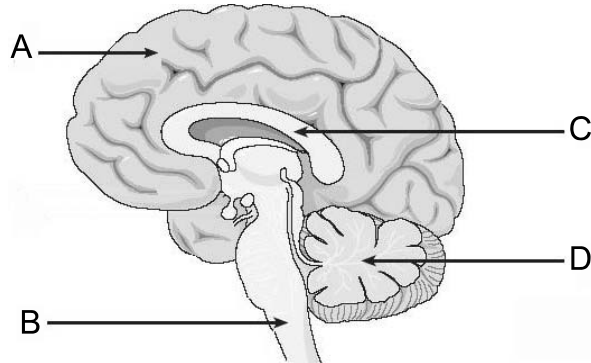


**PART I**  
**Total Value: 75%**

**Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.**

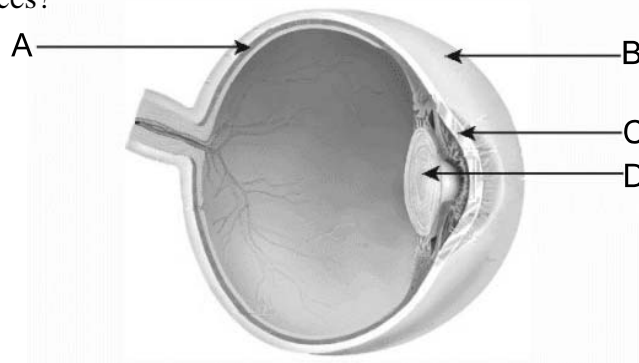
1. Which structure in the diagram below controls balance and muscle coordination?



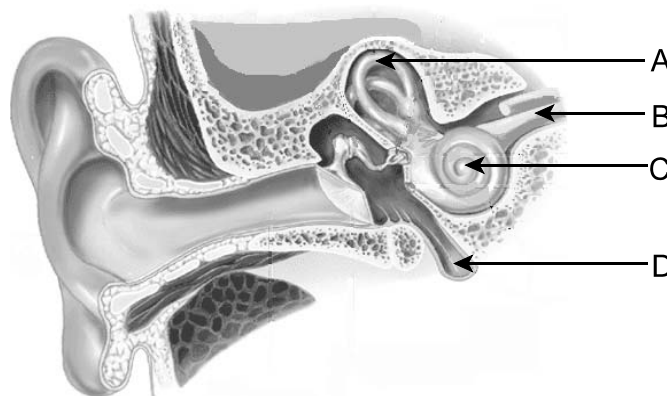
- (A) A  
(B) B  
(C) C  
(D) D
2. Which division of the nervous system is responsible for returning involuntary body functions to normal after a stressful situation?
- (A) central  
(B) parasympathetic  
(C) somatic  
(D) sympathetic
3. Which best shows the difference between the sodium ion concentration inside a resting neuron and outside a resting neuron?
- |     | inside | outside |
|-----|--------|---------|
| (A) | high   | high    |
| (B) | high   | low     |
| (C) | low    | high    |
| (D) | low    | low     |
4. What is the best reason for using marijuana to treat Parkinson's disease?
- (A) It controls pain.  
(B) It controls skeletal muscles.  
(C) It elevates mood.  
(D) It stimulates appetite.
5. In which part of a neuron are neurotransmitters released?
- (A) axon terminal  
(B) dendrite  
(C) myelin sheath  
(D) Schwann cells

6. Which sequence best indicates a simple reflex arc?
- (A) interneuron → sensory neuron → effector → motor neuron  
 (B) interneuron → sensory neuron → motor neuron → effector  
 (C) sensory neuron → interneuron → effector → motor neuron  
 (D) sensory neuron → interneuron → motor neuron → effector
7. Which disorder is caused by a bacterial infection of the membrane surrounding the brain?
- (A) Alzheimer's  
 (B) Huntington's  
 (C) Meningitis  
 (D) Multiple Sclerosis
8. Which best explains why people could have difficulty seeing different colours?
- (A) Their cornea is too thick.  
 (B) Their cornea is too thin.  
 (C) Their retinas contain cones only.  
 (D) Their retinas contain rods only.

9. Which structure in the diagram below changes shape as the eye focuses on objects at different distances?

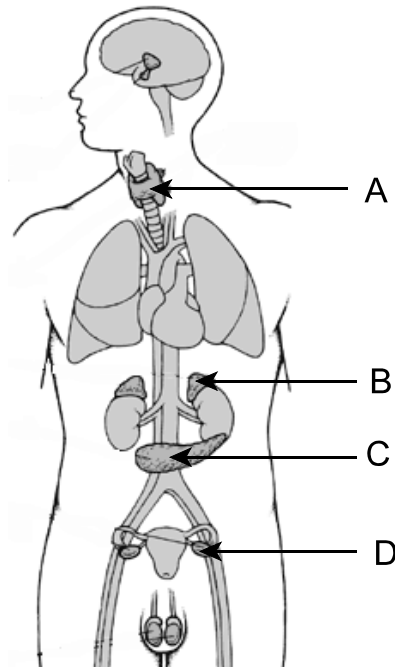


- (A) A  
 (B) B  
 (C) C  
 (D) D
10. Which structure in the diagram requires an implant to prevent chronic ear infections?



- (A) A  
 (B) B  
 (C) C  
 (D) D

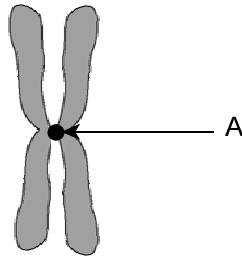
11. What is the main role of the endocrine system?
- (A) coordinate movement of the body  
 (B) defend the body against illness and infection  
 (C) produce chemicals that affect other parts of the body  
 (D) remove waste products from the blood
12. A disruption in the feedback loop of which structure below results in a slower metabolism?



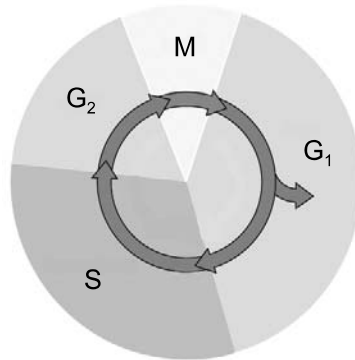
- (A) A  
 (B) B  
 (C) C  
 (D) D
13. If an adult male lacks facial hair, has a high pitched voice and above average body fat, which hormone is most likely secreted in low amounts?
- (A) HGH  
 (B) estrogen  
 (C) melatonin  
 (D) testosterone
14. Which hormone can be used to treat diabetes mellitus?
- (A) glucagon  
 (B) insulin  
 (C) somatotropin  
 (D) thyroxine
15. If a drug completely destroys the cells in the pancreas, which conditions could be expected to develop in the body fluids?

	blood glucose level	urine glucose level
(A)	high	high
(B)	high	low
(C)	low	high
(D)	low	low

16. Which structure is indicated by A in the diagram below?

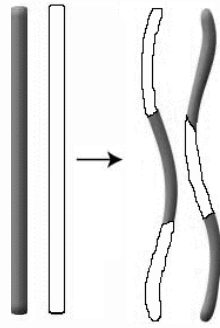


- (A) centriole  
(B) centromere  
(C) chromatid  
(D) chromatin
17. In which stage of the cell cycle below does anaphase occur?



- (A) G<sub>1</sub>  
(B) G<sub>2</sub>  
(C) M  
(D) S
18. If the egg cell of a potato plant has 24 chromosomes, how many chromosomes are found in the root cell?
- (A) 12  
(B) 24  
(C) 36  
(D) 48
19. Which process repairs damaged tissue?
- (A) meiosis  
(B) mitosis  
(C) parthenogenesis  
(D) spermatogenesis
20. Which best describes the daughter cells at the end of meiosis?
- (A) four diploid  
(B) four haploid  
(C) two diploid  
(D) two haploid

21. Which process is represented in the diagram below?



- (A) cytokinesis
- (B) crossing-over
- (C) gene linkage
- (D) nondisjunction

22. Which produces polar bodies?

- (A) cleavage
- (B) fertilization
- (C) fragmentation
- (D) oogenesis

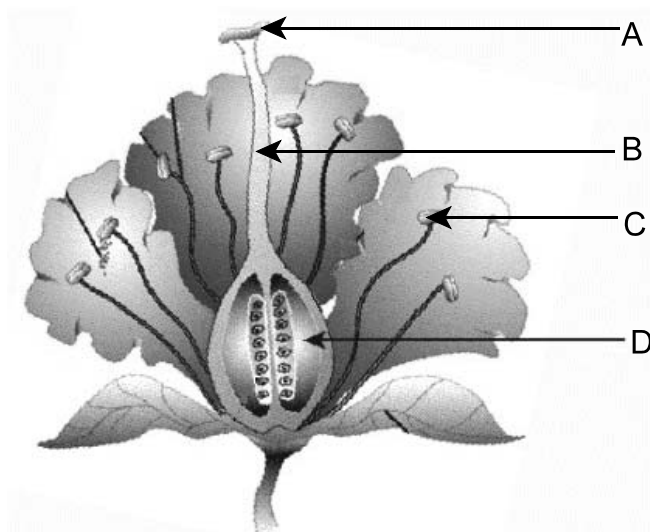
23. What is the function of flagella?

- (A) aid in the penetration of eggs
- (B) allow for motility
- (C) produce genetic material
- (D) store energy

24. Which is composed of secretions from the seminal vesicle, prostate gland, and Cowper's gland?

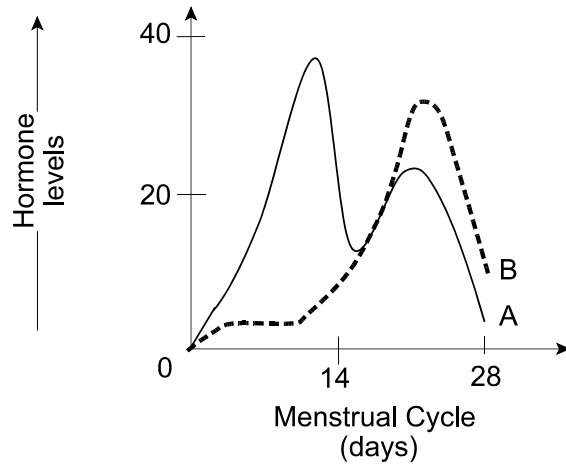
- (A) mucus
- (B) semen
- (C) sperm
- (D) urine

25. In which structure of the diagram below does fertilization occur?



- (A) A
- (B) B
- (C) C
- (D) D

26. Which hormones are represented in the graph below?



	hormone A	hormone B
(A)	estrogen	progesterone
(B)	FSH	LH
(C)	LH	FSH
(D)	progesterone	estrogen

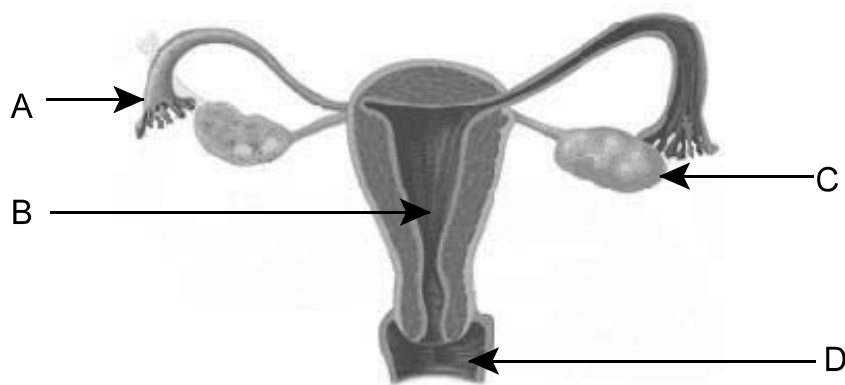
27. Which birth control method is 100% effective?

- (A) abstinence
- (B) Depo-Provera
- (C) diaphragm
- (D) vasectomy

28. Which sexually transmitted infection attacks the immune system?

- (A) AIDS
- (B) chlamydia
- (C) hepatitis
- (D) syphilis

29. In which structure below does endometriosis occur?



- (A) A
- (B) B
- (C) C
- (D) D

30. Which is the path of sperm from production to ejaculation?
- (A) epididymis → seminiferous tubule → urethra → vas deferens  
 (B) epididymis → seminiferous tubule → vas deferens → urethra  
 (C) seminiferous tubule → epididymis → urethra → vas deferens  
 (D) seminiferous tubule → epididymis → vas deferens → urethra
31. Which primary membrane contains a liquid environment for the developing embryo?
- (A) allantois  
 (B) amnion  
 (C) chorion  
 (D) yolk
32. Which gland releases hormones into the bloodstream that aid in the stimulation of uterine contractions?
- (A) adrenal  
 (B) hypothalamus  
 (C) pituitary  
 (D) seminal vesicle

33. In which part of the human female reproductive system do the stages below occur?



- (A) ovary  
 (B) oviduct  
 (C) uterus  
 (D) vagina
34. Which may cause children to be born with deformed or missing limbs?
- (A) alcohol  
 (B) caffeine  
 (C) nicotine  
 (D) thalidomide
35. Which would be given to a pregnant female who is two weeks past her delivery date?
- (A) estrogen  
 (B) oxytocin  
 (C) progesterone  
 (D) prolactin
36. If brown fur (B) is dominant to white fur (b), which best describes the phenotype of an individual with the genotype, Bb?
- (A) heterozygous dominant  
 (B) heterozygous recessive  
 (C) homozygous dominant  
 (D) homozygous recessive

37. What does the phenotype of an organism describe?
- (A) genetic composition  
 (B) physical expression  
 (C) number of amino acids  
 (D) type of chromosomes
38. Which states that the inheritance of alleles for one trait does not affect the inheritance of alleles from another trait?
- (A) disjunction  
 (B) dominance  
 (C) independent assortment  
 (D) natural selection
39. Cat fur colour results from the interaction of three possible alleles: B – black, b – chocolate, and b<sup>l</sup> – cinnamon. The possible phenotypes for cat fur colour are listed below.

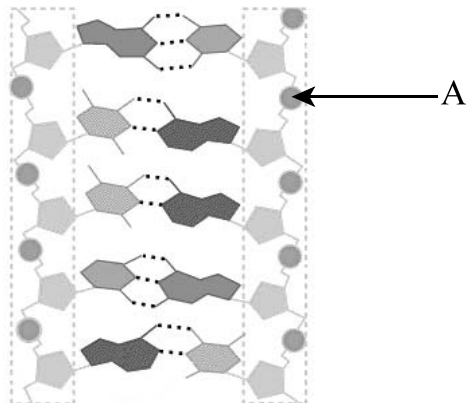
Genotype	Phenotype
BB, Bb, Bb <sup>l</sup>	black
bb, bb <sup>l</sup>	chocolate
b <sup>l</sup> b <sup>l</sup>	cinnamon

- Which best describes the relationship between the alleles?
- (A) The black allele is codominant with the chocolate and cinnamon alleles.  
 (B) The black allele is dominant over the chocolate and cinnamon alleles.  
 (C) The cinnamon allele is codominant with the black and chocolate alleles.  
 (D) The cinnamon allele is dominant over the black and chocolate alleles.
40. Which best describes the frequency of genotypes of the F<sub>2</sub> generation produced from the parental cross, BB × bb?
- (A)  $\frac{1}{4}$ BB,  $\frac{1}{2}$ Bb and  $\frac{1}{4}$ bb  
 (B)  $\frac{1}{2}$ BB,  $\frac{1}{4}$ Bb and  $\frac{1}{4}$ bb  
 (C)  $\frac{1}{2}$ Bb and  $\frac{1}{2}$ BB  
 (D)  $\frac{1}{2}$ Bb and  $\frac{1}{2}$ bb
41. Pink flowers of some species may be produced by crossing red flowers with white flowers. Which explains how this can happen?
- (A) codominance  
 (B) incomplete dominance  
 (C) multiple alleles  
 (D) sex linkage
42. A woman with blood type AB marries a man with blood type B. What is the chance that their child has blood type B?
- (A) 25%  
 (B) 50%  
 (C) 75%  
 (D) 100%



43. Which is an example of a polygenic trait for humans?
- (A) blood type  
 (B) gender  
 (C) height  
 (D) thumb shape
44. Which type of inheritance occurs in human blood types?
- (A) autosomal dominant  
 (B) autosomal recessive  
 (C) multiple alleles  
 (D) sex linked
45. Eye colour in fruit flies is sex linked. Red eye colour is dominant to white eye colour. When two fruit flies were crossed, 7 offspring had white eyes and 21 had red eyes. Which conclusion can be made from these results?
- (A) Both parents are homozygous for red eyes.  
 (B) Both parents are homozygous for white eyes.  
 (C) The father is heterozygous for red eyes.  
 (D) The mother is heterozygous for red eyes.
46. Who used X-ray diffraction images to gain the first clues about the structure of DNA?
- (A) Avery and McCarty  
 (B) Franklin and Wilkins  
 (C) Sutton and Morgan  
 (D) Watson and Crick

47. What is represented by structure A in the diagram below?






- (A) hydrogen bond  
 (B) nitrogen base  
 (C) phosphate  
 (D) sugar
48. If 15% of a nucleotide solution contains thymine, what percentage of the solution would be guanine?
- (A) 15%  
 (B) 30%  
 (C) 35%  
 (D) 85%

49. What is the complimentary base pair for guanine?

- (A) adenine
- (B) cytosine
- (C) thymine
- (D) uracil

50. Which represents a tRNA molecule?

- (A) 
- (B) 
- (C) 

TAC	CGC	CCT	TGC	GTA	CTC	ACT
-----	-----	-----	-----	-----	-----	-----
- (D) 

51. What is the sequence of protein synthesis?

- (A) DNA → mRNA → amino acid → tRNA
- (B) DNA → mRNA → tRNA → amino acid
- (C) DNA → tRNA → amino acid → mRNA
- (D) DNA → tRNA → mRNA → amino acid

52. Where in a cell does adenine bond with thymine?

- (A) endoplasmic reticulum
- (B) golgi apparatus
- (C) nucleus
- (D) ribosomes

53. Which best describes a codon?

- (A) three adjacent nucleotides in DNA that code for one amino acid
- (B) three adjacent nucleotides in DNA that code for one polypeptide chain
- (C) three adjacent nucleotides in tRNA that code for one amino acid
- (D) three adjacent nucleotides in tRNA that code for one polypeptide chain

54. Which chromosomal mutation causes a reversal in the order of the genes?

- (A) duplication
- (B) inversion
- (C) non-disjunction
- (D) translocation

55. Which describes a mutation that can be inherited?

- (A) abnormal lung cell produced by toxins
- (B) a nitrogen base substitution in an egg cell
- (C) random breakage in a liver cell's DNA
- (D) ultraviolet radiation damage to skin cells

Refer to the diagram below to answer the next two questions.

**Amino Acids Coded by mRNA Codons**

First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	<b>STOP</b>	<b>STOP</b>	A
	leucine	serine	<b>STOP</b>	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	<b>START/ methionine</b>	threonine	lysine	arginine	G
G	valine	alanine	aspartate	glycine	U
	valine	alanine	aspartate	glycine	C
	valine	alanine	glutamate	glycine	A
	valine	alanine	glutamate	glycine	G

56. Which amino acid sequence is produced from the DNA template sequence below?

ACA ACC GGC CCC

- (A) cysteine - tryptophan - glycine - proline
- (B) cysteine - tryptophan - proline - glycine
- (C) serine - serine - glycine - proline
- (D) serine - serine - proline - glycine

57. If a thymine deletion occurs on the second codon of AGG UUA CAC, which polypeptide is produced?

- (A) arginine - leucine - histidine
- (B) arginine - phenylalanine
- (C) serine - tyrosine - cysteine
- (D) serine - lysine

58. Which best determines if a fetus has Down syndrome?

- (A) amniocentesis
- (B) CVS
- (C) genetic markers
- (D) X ray

59. Which karyotype indicates Turner syndrome?



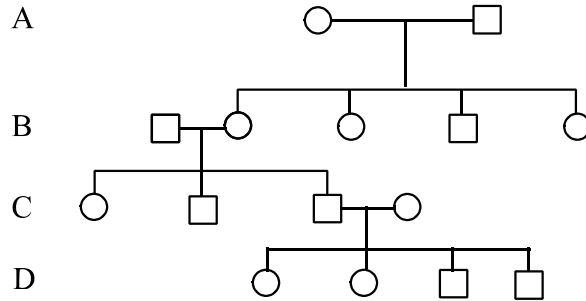
60. Huntington's disease is an autosomal dominant disorder. If one parent is heterozygous for the trait and the other parent is normal, what is the chance of having a child with the disease?

- (A) 25%
- (B) 50%
- (C) 75%
- (D) 100%

61. Which is used to generate large samples of DNA from a single gene?

- (A) chain termination
- (B) fingerprinting
- (C) gel electrophoresis
- (D) polymerase chain reaction

62. Which generation of offspring is indicated by C in the pedigree below?



- (A) F<sub>1</sub>
- (B) F<sub>2</sub>
- (C) P<sub>1</sub>
- (D) P<sub>2</sub>

63. What benefit could most likely arise from the work done by the Human Genome Project?

- (A) early detection of infertility
- (B) early detection of mutations
- (C) elimination of infertility
- (D) elimination of mutations

64. Which organisms appeared first on Earth?

- (A) clams
- (B) dinosaurs
- (C) fish
- (D) single cells

65. Who first stated, "Organisms best suited for the environment are most likely to survive."?

- (A) Darwin
- (B) Lamarck
- (C) Mendel
- (D) Miller

66. Bird wings and insect wings are examples of which type of structure?

- (A) analogous
- (B) embryonic
- (C) homologous
- (D) vestigial

67. Which is true about evolution?

- (A) All dead organisms are preserved as fossils.
- (B) All fossils are found in sedimentary rock.
- (C) Fossils of complex organisms are found closer to the surface.
- (D) Fossils of simple organisms have evolved from complex organisms.

68. The half-life of carbon-14 is 5730 years. How many years old is a fossil that contains  $\frac{1}{4}$  of the original carbon-14 atoms?

- (A) 5730
- (B) 11 460
- (C) 17 190
- (D) 22 920

69. Which best illustrates directional selection for body weight in newborns?

Number of Newborns		
small	medium	large
(A) 25	50	25
(B) 33	33	34
(C) 45	10	45
(D) 75	15	10

70. Which best explains how the different species of finches on the Galapagos Islands evolved from a common ancestor?

- (A) adaptive radiation
- (B) disruptive selection
- (C) gene flow
- (D) genetic drift

71. The frequency of a recessive allele for a certain trait is 0.20 in a population at Hardy-Weinberg equilibrium. What percentage of the individuals in the next generation would be expected to show the dominant trait?

- (A) 16
- (B) 32
- (C) 64
- (D) 96

72. Which promotes speciation?

- (A) emigration
- (B) geographic isolation
- (C) immigration
- (D) random mating

73. Which type of isolation best explains why pine marten on the island of Newfoundland are different from pine marten in Labrador?

- (A) behavioural
- (B) gametic
- (C) habitat
- (D) temporal

74. Who proposed the theory of Punctuated Equilibrium?

- (A) Darwin and Wallace
- (B) Gould and Eldridge
- (C) Miller and Urey
- (D) Oparin and Haldane

75. Which theory would be supported if microscopic life were found on the outside of the Space Shuttle when it returned to Earth from outer space?

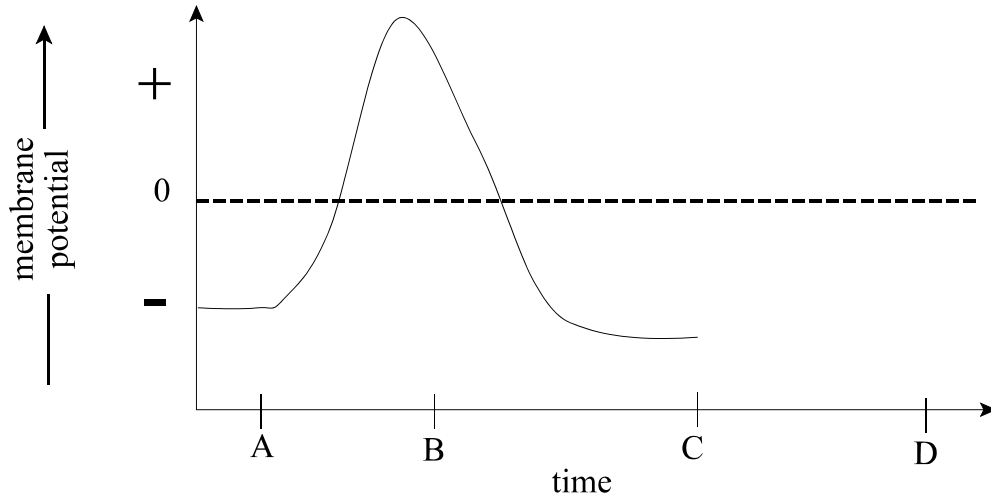
- (A) Gaia
- (B) Intelligent Design
- (C) Panspermia
- (D) Symbiogenesis

**PART II**  
**Total Value: 25%**

**Instructions: Complete all items in this section. Your responses must be clearly presented in a well-organized manner.**

**Value**

3% 76.(a) The graph below shows the membrane potential of the inside of a neuron.



- (i) Indicate on the graph, with an X, when the neuron was stimulated. Justify your choice.

---

---

---

---

---

---

---

---

- (ii) Extend the graph above to show what the membrane potential would look like from time C to D, assuming there is no further stimulus.

- 2% (b) When humans consume excessive amounts of alcohol they lose their ability to reason, walk straight, and breathe normally. List two parts of the brain that are affected by alcohol consumption. Justify your choices.

---

---

---

---

---

---

---

---

---

---

---

---

**Value**

5% 77.(a) A couple have been trying to have a baby for over a year. Tests have shown that the male's sperm are healthy and numerous.

(i) What are two possible causes of the couple's inability to conceive?

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

(ii) What is one way to correct this problem without using reproductive technologies?

---

---

---

---

---

---

(iii) What are two ways to correct this problem using reproductive technologies?

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---



**Value**

2% 77.(b) Give two reasons why using adult stem cells for therapeutic cloning may be considered more desirable than using embryonic stem cells.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

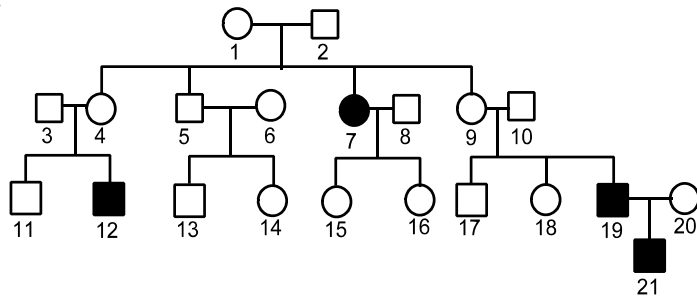
---

3% 78.(a) In a cross between two pea plants, 50% of the offspring were tall and 75% had round seeds. If tallness (T) is dominant to dwarfness (t) and round seeds (R) are dominant to wrinkled seeds (r), what are the genotypes of the parents? Show all your workings.

genotype of the parents: \_\_\_\_\_

**Value**

4% 78.(b) The pedigree below shows the occurrence of the recessive genetic disorder, PKU, in a family.



(i) If the allele for PKU is  $n$ , what are the genotypes of individuals 7 and 20?

individual 7: \_\_\_\_\_ individual 20: \_\_\_\_\_

(ii) Is individual 3 a carrier of PKU? Explain why or why not.

---

---

---

---

---

---

---

---

---

---

2% (c) Some farms in Newfoundland and Labrador are growing genetically modified tomato plants that contain antifreeze protein from cold water fish.

(i) Why would farmers want to do this?

---

---

---

---

---

---

(ii) Describe one way in which genetic engineering can be used to do this.

---

---

---

---

---

---

**Value**

2% 79.(a) If a polar bear mated with a black bear, give two reasons why the offspring would not be viable, fertile individuals.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

2% (b) An island contains a breeding population of moose. Recently, a white moose was born on the island. This also happened twenty years ago. If no animals have ever entered or left the island, give two reasons for the occurrence of the white moose.

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---

---