

PART I
Total Value: 75%

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

1. Which regulates the contraction of voluntary muscles in the human arm?

- (A) autonomic nervous system
- (B) hypothalamus
- (C) pituitary gland
- (D) somatic nervous system

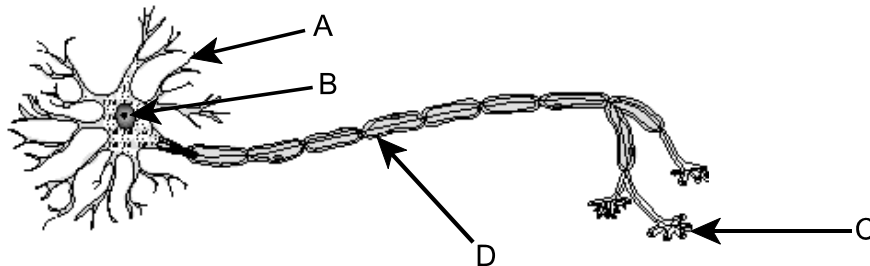
2. Which is controlled by the cerebellum?

- (A) coordination of muscle movement
- (B) intelligence
- (C) interpretation of visual information
- (D) memory

3. Damage to which structure in a neuron causes multiple sclerosis?

- (A) cell body
- (B) dendrite
- (C) myelin sheath
- (D) nodes of Ranvier

4. Which structure in the diagram below increases the speed of a nerve transmission?



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

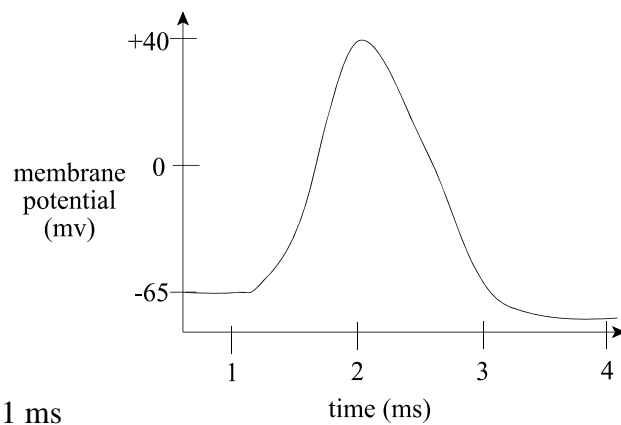
5. The strength of response of a nerve impulse is always the same. What name is given to this phenomenon?

- (A) action potential
- (B) all or none principle
- (C) refractory response
- (D) reverse polarity

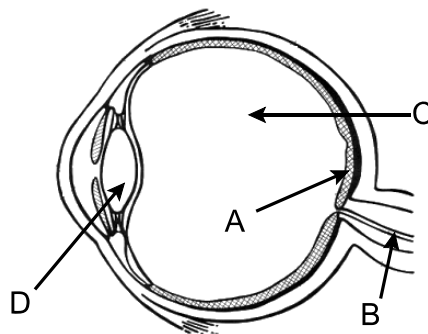
6. Which neurotransmitter accounts for most excitatory transmissions in the brain?

- (A) acetylcholine
- (B) glutamate
- (C) noradrenaline
- (D) serotonin

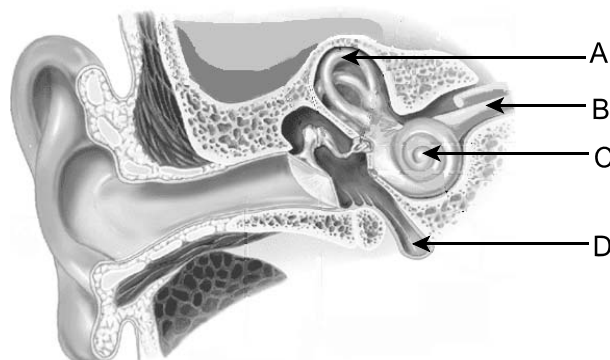
7. The graph below shows the change in electrical potential of a neural membrane versus time of transmission. When do the potassium channels close?



- (A) 0 to 1 ms
 (B) 1 to 2 ms
 (C) 2 to 3 ms
 (D) 3 to 4 ms
8. Which reflex in an adult results in the bunching downward movement of all the toes?
- (A) Achilles
 (B) Babinski
 (C) knee-jerk
 (D) pupillary
9. Which structure in the diagram below is composed of rods and cones?



- (A) A
 (B) B
 (C) C
 (D) D
10. Which would correct myopia?
- (A) cochlear implants
 (B) cornea transplant
 (C) eyeglasses
 (D) hearing aid
11. Which structure below is responsible for balance and equilibrium?



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

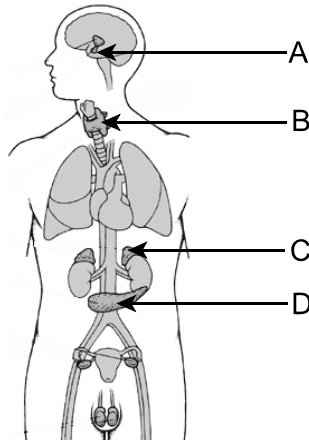
12. Which gland produces melatonin?

- (A) adrenal
- (B) anterior pituitary
- (C) pineal
- (D) thyroid

13. Which hormone is responsible for uterine contractions during childbirth?

- (A) adrenaline
- (B) HGH
- (C) oxytocin
- (D) TSH

14. Which structure below regulates the secretion of hormones from the ovaries?

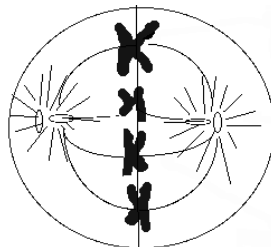


- (A) A
- (B) B
- (C) C
- (D) D

15. If a person has experienced an extended period of starvation, which describes the hormone levels of insulin and glucagon in their blood?

	Insulin	Glucagon
(A)	high	high
(B)	high	low
(C)	low	high
(D)	low	low

16. Which phase of mitosis is represented by the diagram below?

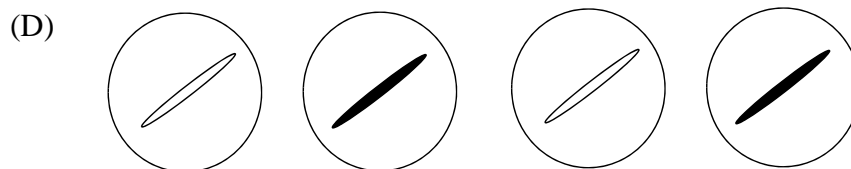
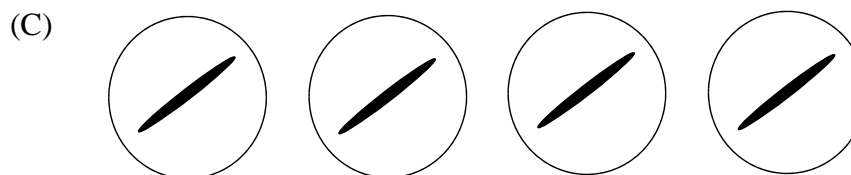
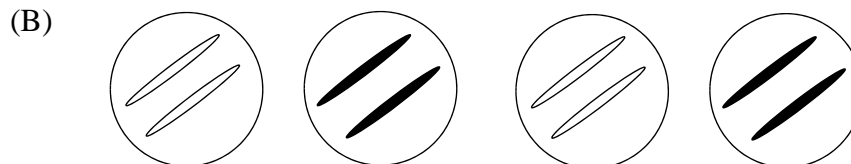
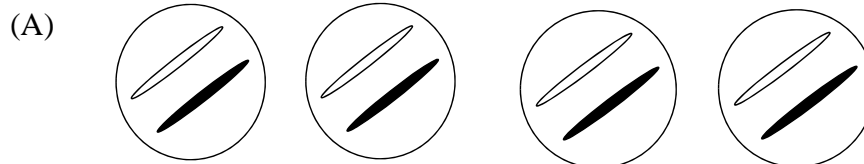
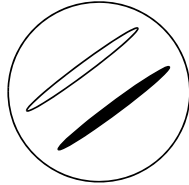


- (A) interphase
- (B) metaphase
- (C) prophase
- (D) telophase

17. During which phase of the cell cycle does DNA replicate?

- (A) anaphase
- (B) interphase
- (C) metaphase
- (D) prophase

18. If the cell below undergoes meiosis, which best represents the daughter cells?



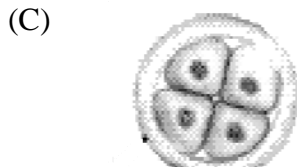
19. For humans, what is the normal chromosome number in cells produced by mitosis and meiosis?

	Mitosis	Meiosis
(A)	23	23
(B)	23	46
(C)	46	23
(D)	46	46

20. In human females, how many functional egg cells are formed as a result of one primary sex cell undergoing normal meiotic cell division?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

21. In which stage of embryonic development would stem cells be removed?



22. Which part of a sperm cell contains enzymes that help sperm penetrate an egg cell?

- (A) acrosome
- (B) flagellum
- (C) mitochondria
- (D) nucleus

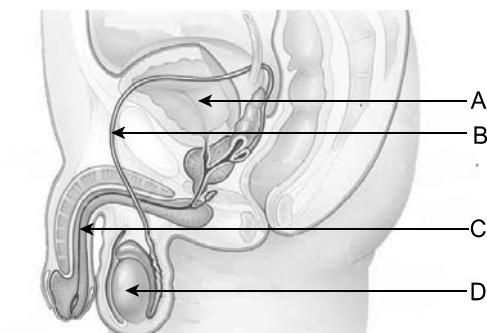
23. Which products are formed from meiosis in the anther of flowering plants?

- (A) generative cell nucleus and sperm cell nucleus
- (B) generative cell nucleus and tube cell nucleus
- (C) sperm cell nuclei only
- (D) tube cell nuclei only

24. Where does maturation of sperm occur?

- (A) epididymis
- (B) interstitial cells
- (C) seminiferous tubules
- (D) urethra

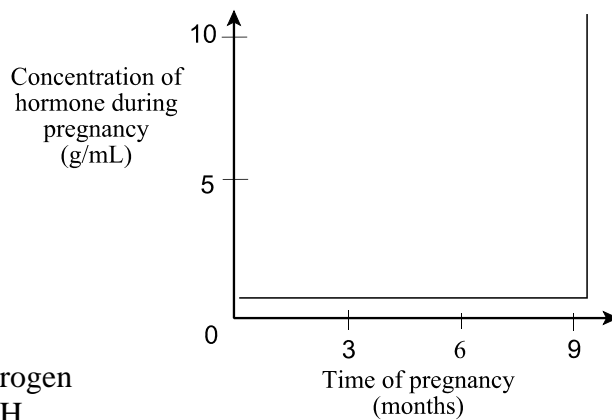
25. Which structure in the diagram below is a pathway for semen and urine?



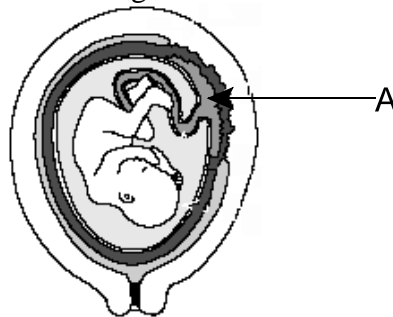
- (A) A
- (B) B
- (C) C
- (D) D

26. Which occurs during the first 13 days of the menstrual cycle?
- (A) Estrogen is secreted.
 - (B) HCG is produced.
 - (C) Progesterone is produced.
 - (D) Testosterone is secreted.
27. Which secretes progesterone?
- (A) corpus luteum
 - (B) follicles
 - (C) pituitary gland
 - (D) vaginal cells
28. Which is **least** affected by chlamydia?
- (A) birth
 - (B) fertilization
 - (C) implantation
 - (D) ovulation
29. Which hormone is injected to cause superovulation?
- (A) estrogen
 - (B) FSH
 - (C) LH
 - (D) progesterone
30. If a male is infertile due to a low sperm count, which structure is most likely failing?
- (A) Cowper's gland
 - (B) prostate
 - (C) seminal vesicle
 - (D) seminiferous tubules
31. If a female suffers from painful menstruation and is unable to have children, what is the most likely problem?
- (A) blocked oviduct
 - (B) damaged egg
 - (C) endometriosis
 - (D) failure to ovulate
32. What risk is associated with using an intrauterine device?
- (A) blood clots
 - (B) hormonal imbalance
 - (C) pelvic inflammatory disease
 - (D) urinary tract infection
33. During development, which primary membrane forms the placenta?
- (A) allantois
 - (B) amnion
 - (C) chorion
 - (D) yolk

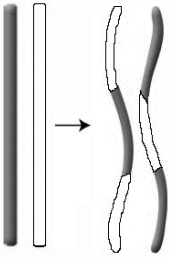
34. Which maternal hormone is represented in the graph below?

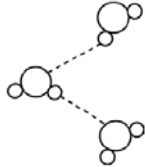

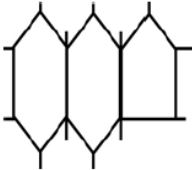
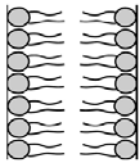


- (A) estrogen
(B) FSH
(C) oxytocin
(D) progesterone
35. What is the function of structure A in the diagram below?



- (A) divides female gametes by meiosis
(B) exchanges materials between mother and fetus
(C) protects the embryo from mechanical shock
(D) stores yolk for the developing fetus
36. Which combination of alleles allow a recessive genotype to be expressed?
- (A) heterozygous
(B) homozygous
(C) hybrid
(D) variation
37. In what percentage of heterozygous individuals will a dominant allele be expressed?
- (A) 0 %
(B) 25 %
(C) 50 %
(D) 100 %
38. Who first explained the principles of dominance, segregation, and independent assortment?
- (A) Levene
(B) Mendel
(C) Sutton
(D) Watson
39. Two black-haired guinea pigs produced seven offspring. Only one of these offspring had white hair. Based on this information, which statement is true?
- (A) Both parents carried genes for white hair.
(B) Hair colour is a codominant trait in guinea pigs.
(C) Only one of the parents carried genes for white hair.
(D) White hair colour is a dominant trait in guinea pigs.

40. In four o'clock flowers, red flower colour and white flower colour are incompletely dominant. If a red flower is crossed with a white flower, what percent of the offspring will have pink flowers?
- (A) 0 %
 (B) 25 %
 (C) 50 %
 (D) 100 %
41. Tall pea plants are dominant to short pea plants. If a geneticist wishes to determine the genotype of a tall pea plant, what plant should be crossed with the tall plant?
- (A) heterozygous short
 (B) heterozygous tall
 (C) homozygous short
 (D) homozygous tall
42. If a male with type O blood marries a female with type AB blood, what is the chance of them having a girl with type A blood?
- (A) 0
 (B) $\frac{1}{4}$
 (C) $\frac{1}{2}$
 (D) $\frac{3}{4}$
43. Which determines human blood types?
- (A) incomplete dominance
 (B) multiple alleles
 (C) X-linkage
 (D) Y-linkage
44. What is reduced as a result of the process below?
- 
- (A) gene linkage
 (B) mutation
 (C) segregation
 (D) sex linkage
45. Colour blindness is a recessive X-linked trait. If a mother is colour blind and her mate is not colour blind, which describes how many of her children must be colour blind?
- (A) 50% of female offspring
 (B) 50% of male offspring
 (C) 100% of female offspring
 (D) 100% of male offspring
46. Which is contained in molecules of DNA and mRNA?
- (A) deoxyribose
 (B) double strands
 (C) genetic codes
 (D) thymine

47. If 12% of a DNA sample contains adenine, what percentage of guanine does it contain?
- (A) 12 %
 - (B) 24 %
 - (C) 36 %
 - (D) 38 %
48. At what organelle do most peptide bonds between amino acids form?
- (A) lysosomes
 - (B) membrane
 - (C) mitochondria
 - (D) ribosomes
49. Which model best represents DNA?
- (A) 
 - (B) 
 - (C) 
 - (D) 
50. Which is a difference between DNA and RNA?
- (A) DNA contains ribose while RNA contains deoxyribose.
 - (B) DNA contains thymine while RNA contains the base uracil.
 - (C) DNA is found in the cytoplasm while RNA is only found in the nucleus.
 - (D) DNA is single-stranded while RNA is double-stranded.
51. What is the chance that two parents who are carriers of sickle cell anemia will have a child with sickle cell anemia?
- (A) 25%
 - (B) 50%
 - (C) 75%
 - (D) 100%
52. Which is used to study chromosomes?
- (A) genotype
 - (B) karyotype
 - (C) pedigree chart
 - (D) punnet square

53. Which procedure is used to treat a genetic disorder detected at birth?
- (A) amniocentesis
 - (B) gene therapy
 - (C) genetic counselling
 - (D) ultrasound

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

Amino Acids coded by RNA Codons

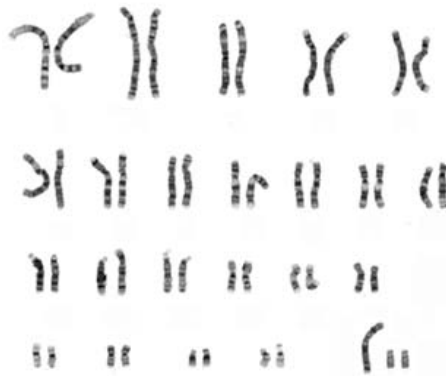
First Letter	Second Letter				Third Letter
	U	C	A	G	
U	phenylalanine	serine	tyrosine	cysteine	U
	phenylalanine	serine	tyrosine	cysteine	C
	leucine	serine	STOP	STOP	A
	leucine	serine	STOP	tryptophan	G
C	leucine	proline	histidine	arginine	U
	leucine	proline	histidine	arginine	C
	leucine	proline	glutamine	arginine	A
	leucine	proline	glutamine	arginine	G
A	isoleucine	threonine	asparagine	serine	U
	isoleucine	threonine	asparagine	serine	C
	isoleucine	threonine	lysine	arginine	A
	START/ methionine	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

54. Which amino acid is carried by the anticodon UAC ?
- (A) isoleucine
 - (B) leucine
 - (C) methionine
 - (D) tyrosine
55. Which DNA sequence codes for the portion of the insulin protein sequence below?

phenylalanine - valine - asparagine - glutamine

- (A) AAA CAA TTC CAC
- (B) AAG CAA TTA GTT
- (C) CAC GAG AAC GTA
- (D) TTC GTA AAC GAG

56. Which best explains a frameshift mutation?
- (A) It can occur only in mRNA.
 - (B) It can occur only in rRNA.
 - (C) It is caused by a nucleotide substitution in the DNA sequence.
 - (D) It is caused by the insertion or deletion of a nucleotide.
57. Why are dominant mutations easier to detect than recessive mutations?
- (A) They are always lethal and obviously seen.
 - (B) They are always present in high amounts.
 - (C) They are expressed in homozygous and heterozygous individuals.
 - (D) They are expressed in homozygous individuals only.
58. Which best describes the karyotype below?



	Sex	Genetic syndrome
(A)	female	Jacobs
(B)	female	Klinefelter
(C)	male	Jacobs
(D)	male	Klinefelter

59. Which genetic disorder is characterized by a buildup of fatty tissue in the nervous system?
- (A) Down syndrome
 - (B) phenylketonuria
 - (C) sickle-cell anemia
 - (D) Tay-Sachs
60. In 1994, a new tomato was created containing DNA from fish. Which was most likely used to develop this new type of tomato?
- (A) amniocentesis
 - (B) cross-pollination
 - (C) genetic engineering
 - (D) karyotyping
61. Which technique could allow doctors to create perfectly matched bone marrow for a cancer patient?
- (A) differentiation
 - (B) gene therapy
 - (C) reproductive cloning
 - (D) therapeutic cloning

62. Which procedure detects a genetic disorder by removing cells from the membranous sac around the developing embryo?

- (A) CVS
- (B) fetoscopy
- (C) genetic marker
- (D) linked marker

63. Why is heat applied to a solution of DNA and enzymes during a polymerase chain reaction?

- (A) break the weak bonds between the DNA bases
- (B) break the weak bonds between the sugar and phosphate
- (C) provide energy for the enzyme
- (D) slow down the enzyme

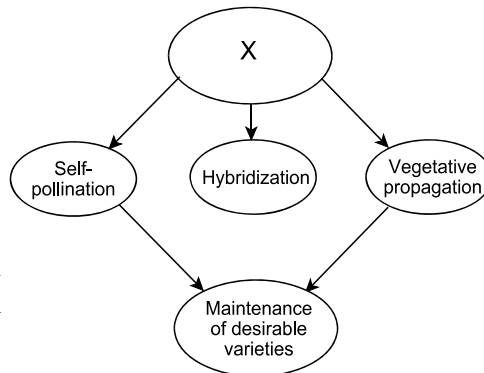
64. What was the goal of the Human Genome Project?

- (A) determine the contents of all human DNA
- (B) eliminate inherited diseases
- (C) perfect recombinant DNA techniques
- (D) refine the use of human genes

65. Which scientist is correctly paired with his area of research?

- (A) Charles Darwin - natural selection
- (B) Gregor Mendel - origin of life on Earth
- (C) Jean Lamarck - heredity of factors
- (D) Stanley Miller - survival of the fittest

66. The diagram below represents some methods used by plant growers to produce and maintain desirable varieties of plants. Which best represents X?



- (A) adaptive radiation
- (B) artificial selection
- (C) natural selection
- (D) use and disuse

67. Who proposed a theory of evolution stating that acquired characteristics can be passed on to the next generation?

- (A) Crick
- (B) Cuvier
- (C) Lamarck
- (D) Morgan

68. Which best explains how the modern theory of evolution is different from Darwin's theory of evolution?

- (A) The modern theory does not consider the effects of genetic change.
- (B) The modern theory does not include the concept of overproduction.
- (C) The modern theory includes mutations as an explanation for variation.
- (D) The modern theory includes the concept of use and disuse.

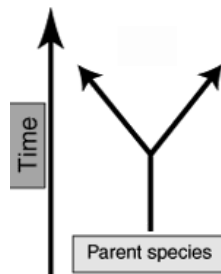
69. If the embryos of dogs and pigs resemble each other in the early stages of development, which is common to both species?

- (A) ancestry
- (B) blood
- (C) chromosomes
- (D) habitat

70. If the frequency of a recessive allele in a Hardy-Weinberg population is 0.01, what frequency of the population would you expect to express the recessive trait?

- (A) 0.0001
- (B) 0.0010
- (C) 0.0100
- (D) 0.1000

71. Which type of evolution is best explained by the diagram below?



- (A) adaptive
- (B) convergent
- (C) disruptive
- (D) divergent

72. Which prevents two gametes from uniting to form a zygote?

- (A) convergence
- (B) postzygotic barriers
- (C) prezygotic barriers
- (D) speciation

73. Which describes Earth as a living “superorganism” that is maintained and regulated by life on its surface?

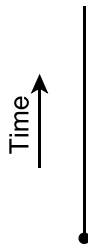
- (A) Gaia hypothesis
- (B) intelligent design
- (C) spontaneous generation
- (D) symbiogenesis

74. According to the heterotroph hypothesis, what was lacking in the atmosphere of primitive Earth?

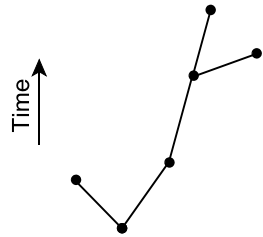
- (A) ammonia
- (B) hydrogen
- (C) oxygen
- (D) water

75. If each point in the diagrams below represents a new species, which best represents gradualism?

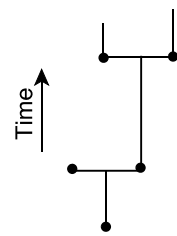
(A)



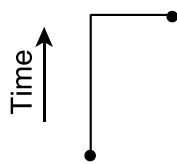
(B)



(C)



(D)



PART II
Total Value: 25%

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

Value

2% 76.(a) Describe two differences between nerve responses and endocrine responses.

3% (b) A person exhibits increased appetite, muscle weakness, increased metabolic rate, excessive heat production, sweating and warm skin. What is the probable cause of this condition and give two ways it can be treated?

Value

3% 77.(a) Describe three differences between human egg cells and sperm cells.

2% (b) Give two reasons why underdeveloped countries have high birth rates.

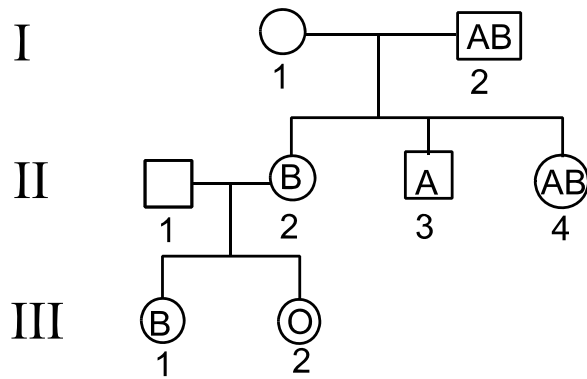
2% (c) Vinblastine is a standard therapeutic drug used in the treatment of cancer. It prevents the formation of spindle fibres during mitosis.

(i) How does this drug affect chromosome movement?

(ii) Why is this drug effective in the treatment of cancer?

Value

2% 78. (a) The pedigree below shows the human blood types for three generations of a family. What is one possible genotype of individual I-1? Explain.



5% (b) In humans, a widow's peak (W) is dominant to a continuous hairline (w) and short fingers (S) are dominant to long fingers (s). A female with a continuous hairline and short fingers and a male with a widow's peak and long fingers produced a child with a continuous hairline and long fingers.

(i) What are the genotypes of each parent? Show workings.

mother's genotype: _____ father's genotype: _____

(ii) What is the chance that the couple's next child will have a widow's peak and short fingers? Show workings.

Value

2% 78.(c) Give two reasons why the moose population on the island of Newfoundland might differ from the moose population in Labrador.

2% 79.(a) Lake Vostok is a large freshwater lake buried below four kilometres of ice in Antarctica. The extreme conditions in this lake appear to be quite different from all other parts of Earth. Some scientists are seeking approval to insert a robot probe from the surface of Earth down into the lake to obtain a sample of water. Give two reasons why scientists want a sample of water from Lake Vostok.

2% (b) The half life of uranium-235 is 713 million years. What fraction of U-235 remains in a fossil after 2139 million years? Show workings.