

PART I
Total Value: 75%

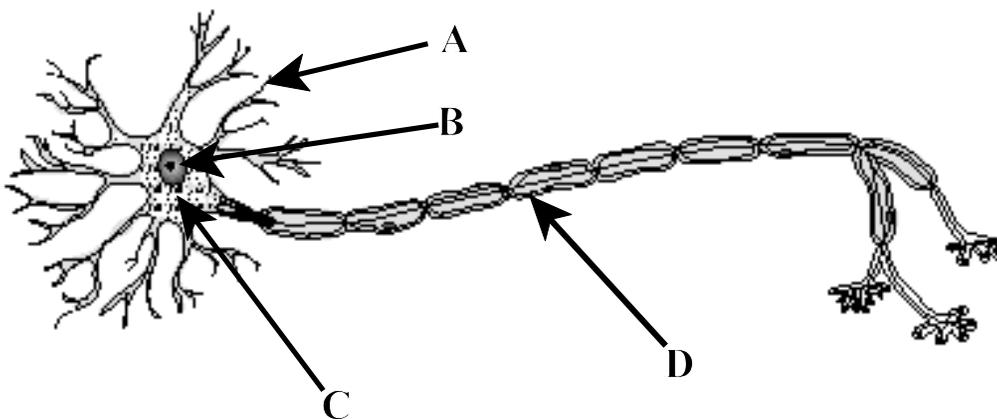
Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided.

1. Which structure is part of the central nervous system?
 - (A) heart
 - (B) skin
 - (C) spinal cord
 - (D) thyroid gland

2. Which part of the brain controls hunger, body temperature, and aggression?
 - (A) cerebellum
 - (B) cerebrum
 - (C) hypothalamus
 - (D) thalamus

3. Which division of the nervous system is directly responsible for physiological responses to fear?
 - (A) parasympathetic
 - (B) sensory
 - (C) somatic
 - (D) sympathetic

4. Which region of the neuron below enhances the rate of impulse transmission?



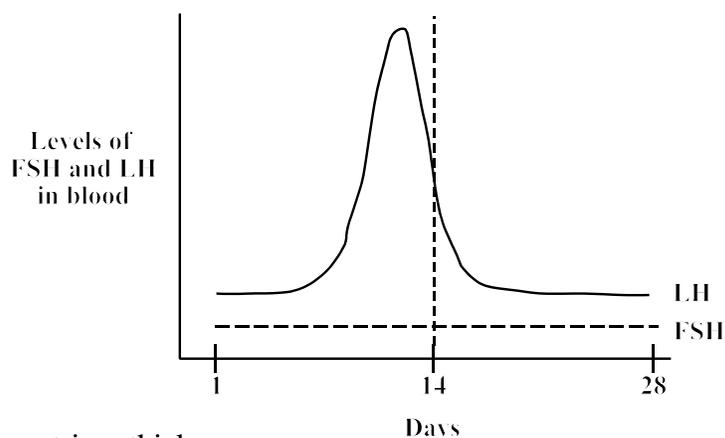
- (A) A
 - (B) B
 - (C) C
 - (D) D
-
5. What is the normal ion distribution outside the neural membrane when a neuron is at rest?

	K⁺ concentration	Na⁺ concentration
(A)	high	high
(B)	high	low
(C)	low	high
(D)	low	low

6. Which neurotransmitter stimulates skeletal muscles but inhibits cardiac muscles?
- (A) acetylcholine
 - (B) dopamine
 - (C) glutamate
 - (D) serotonin
7. Which part of the nerve cell is affected most by multiple sclerosis?
- (A) axon
 - (B) cell body
 - (C) dendrites
 - (D) myelin sheath
8. Which part of the human eye is considered to be an adaptation for living in a low light environment?
- (A) cones
 - (B) iris
 - (C) retina
 - (D) rods
9. Which structure of the human ear allows air pressure to equalize?
- (A) cochlea
 - (B) eustachian tube
 - (C) hammer
 - (D) semi-circular canal
10. Which gland secretes melatonin?
- (A) lacrimal
 - (B) pineal
 - (C) pituitary
 - (D) sweat
11. Which gland functions improperly when there is a lack of iodine in the diet?
- (A) adrenal
 - (B) salivary
 - (C) tear
 - (D) thyroid
12. Why do protein hormones need to trigger a second messenger to activate a target cell?
- (A) They are not water soluble.
 - (B) They bind to multiple types of cells.
 - (C) They cannot cross cell membranes.
 - (D) They require activation by ATP.
13. Which disorder is caused by an over-secretion of the human growth hormone (HGH)?
- (A) diabetes mellitus
 - (B) dwarfism
 - (C) gigantism
 - (D) hyperthyroidism

14. Which is responsible for maintaining a relatively constant body temperature?
- (A) antagonistic hormones
 - (B) negative feedback system
 - (C) pituitary hormones
 - (D) positive feedback system
15. What is most likely present in high amounts in an individual who has been fasting for 24 hours?
- (A) glucagon
 - (B) glucose
 - (C) insulin
 - (D) oxytocin
16. When do tetrads form in meiosis(I)?
- (A) anaphase (I)
 - (B) metaphase (I)
 - (C) prophase (I)
 - (D) telophase (I)
17. Which phase of meiosis, if not conducted properly, could result in the formation of one daughter cell having 21 chromosomes and the other daughter cell having 19?
- (A) anaphase (I)
 - (B) metaphase (I)
 - (C) prophase (II)
 - (D) telophase (II)
18. Which is true for a species whose diploid number is 32?
- (A) A gamete belonged to the species has 16 chromosomes.
 - (B) Spermatocytes of the species have 32 chromosomes.
 - (C) The species has a total of 64 chromosomes.
 - (D) The species has 32 homologous pairs of chromosomes.
19. Which relative would be the best stem cell donor for a male requiring stem cell replacement?
- (A) father
 - (B) grandmother
 - (C) sister
 - (D) uncle
20. Which mode of reproduction involves an outgrowth on the parent organism?
- (A) budding
 - (B) fission
 - (C) fragmentation
 - (D) spore production

21. Which part of a flower produces male gametes?
- (A) anther
 (B) filament
 (C) ovule
 (D) style
22. How does the scrotum help testes function properly?
- (A) keeps testes cooler than normal body temperature
 (B) protects testes from external and internal damage
 (C) provides space for testes to enlarge at sexual maturity
 (D) shortens the distance semen travels during ejaculation
23. Where do developing sperm cells undergo meiosis?
- (A) epididymis
 (B) seminal vesicles
 (C) seminiferous tubules
 (D) vas deferens
24. Where does fertilization usually take place in the human female reproductive system?
- (A) cervix
 (B) ovary
 (C) oviduct
 (D) uterus
25. What can be concluded from the graph below?



- (A) endometrium thickens
 (B) follicle matures
 (C) ovulation occurs
 (D) pregnancy does not occur
26. Which hormone initiates sperm production in males and maturation of eggs in females?
- (A) follicle stimulating hormone
 (B) human growth hormone
 (C) progesterone
 (D) testosterone
27. Which sexually transmitted infection is incurable?
- (A) chlamydia
 (B) genital herpes
 (C) gonorrhea
 (D) syphilis

28. What does an intrauterine device (IUD) prevent?
- (A) ejaculation
 - (B) implantation
 - (C) maturation
 - (D) ovulation
29. Which is the most effective form of birth control?
- (A) condom
 - (B) diaphragm
 - (C) spermicidal jellies
 - (D) tubal ligation
30. Which primary membrane contributes to the development of the placenta?
- (A) allantois
 - (B) amnion
 - (C) chorion
 - (D) yolk sac
31. What is a nearly hollow ball of cells that results from cleavage?
- (A) blastocyst
 - (B) gastrula
 - (C) morula
 - (D) neural fold
32. Which diagnostic technique detects physical abnormalities in a developing fetus?
- (A) amniocentesis
 - (B) CVS
 - (C) EEG
 - (D) ultrasound
33. Which hormone is detected by home pregnancy tests?
- (A) follicle stimulating hormone
 - (B) luteinizing hormone
 - (C) progesterone
 - (D) prostoglandins
34. Which hormone is most likely contained in a drug that initiates labour?
- (A) estrogen
 - (B) oxytocin
 - (C) prolactin
 - (D) testosterone
35. How can a female become infertile?
- (A) blocked oviducts
 - (B) blocked ureter
 - (C) obstruction in the epididymis
 - (D) obstruction in the vas deferens

36. For which term can fur colour be used as an example?
- (A) genotype
 - (B) phenotype
 - (C) dominant allele
 - (D) recessive allele
37. Which genotype will cause a recessive trait to be expressed?
- (A) Tt
 - (B) TT
 - (C) tt
 - (D) tT
38. What is the expected phenotypic ratio in a monohybrid cross where both parents are heterozygous?
- (A) 1:4
 - (B) 2:2
 - (C) 3:1
 - (D) 4:0
39. Which parental cross would produce 25% of its offspring with the recessive trait?
- (A) TT × TT
 - (B) tt × Tt
 - (C) Tt × Tt
 - (D) tt × tt
40. Which parental cross would lead to offspring showing a 9:3:3:1 phenotypic ratio in the second filial (F₂) generation?
- (A) Ddtt × DDTt
 - (B) DdTt × DdTt
 - (C) DdTt × DdTT
 - (D) DDTT × ddt
41. A herd of cattle contains equal numbers of four different phenotypes. If the alleles are on separate chromosomes, which cross would most likely create this distribution?
- (A) BbHh × BbHh
 - (B) Bbhh × bbHH
 - (C) bbhh × BBHH
 - (D) Bbhh × bbHh
42. When a white snapdragon flower and a red snapdragon flower are crossed, pink snapdragon flowers are produced. Which explains this pattern of inheritance?
- (A) co-dominance
 - (B) incomplete dominance
 - (C) multiple alleles
 - (D) multiple genes

43. Which pattern of inheritance for human blood types is possible?

	mother's parents	father	child
(A)	I ^A I ^A and ii	I ^B i	ii
(B)	I ^A i and ii	ii	I ^A I ^B
(C)	I ^B I ^B and ii	I ^A I ^A	I ^B i
(D)	ii and ii	I ^A I ^B	ii

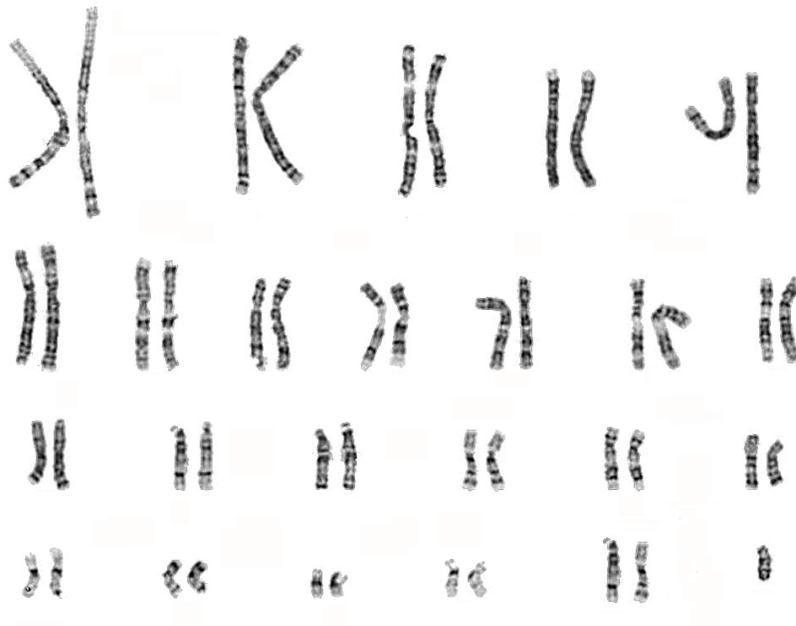
44. Which genotype must be used in a test cross to determine an unknown genotype?

- (A) heterozygous dominant
- (B) heterozygous recessive
- (C) homozygous dominant
- (D) homozygous recessive

45. Which process separates linked genes?

- (A) crossing-over
- (B) mutation
- (C) nondisjunction
- (D) polyploidy

46. Which genetic disorder could be diagnosed from the human karyotype below?



- (A) Down Syndrome
- (B) Jacobs Syndrome
- (C) Klinefelter Syndrome
- (D) Turner Syndrome

47. If a female, exhibiting a recessive X-linked trait, marries a normal male, what percentage of their sons will most likely exhibit the recessive trait?

- (A) 0%
- (B) 25%
- (C) 50%
- (D) 100%

48. Who determined the double helix structure of the DNA molecule?
- (A) Darwin and Lamarck
 - (B) Hershey and Chase
 - (C) Watson and Crick
 - (D) Wilkins and Franklin

Use 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

49. Which nucleotide sequence signals termination?
- (A) AAU
 - (B) AGU
 - (C) UGA
 - (D) UGG
50. If the polypeptide sequence, phenylalanine - isoleucine - threonine, were produced through transcription, what mRNA sequence was present originally?
- (A) AAA UAA UGG
 - (B) AAG UAU AAU
 - (C) UUC AUG ACA
 - (D) UUU AUU ACC

51. Which sugar is present in a DNA nucleotide?
- (A) deoxyribose
 - (B) glucose
 - (C) ribose
 - (D) sucrose
52. If adenine makes up 28% of all nucleotides in a human being, what percentage of the nucleotides are guanine?
- (A) 22%
 - (B) 28%
 - (C) 44%
 - (D) 72%
53. Which process starts when an mRNA molecule binds to an active ribosome?
- (A) elongation
 - (B) initiation
 - (C) transcription
 - (D) translation
54. Why would an individual die if transcription stopped?
- (A) DNA replication would stop
 - (B) number of phosphate groups would decrease
 - (C) number of thymine bases would decrease
 - (D) protein synthesis would stop
55. If a DNA segment has the sequence ATG TCG CAT, what is the sequence of its codon?
- (A) TAC AGC GTA
 - (B) TAC AGC GUA
 - (C) UAC AGC GTA
 - (D) UAC AGC GUA
56. Which describes a change in the nucleotide sequence of DNA?
- (A) anticodon
 - (B) codon
 - (C) mutation
 - (D) translation
57. What part of a DNA molecule determines the genetic code?
- (A) amino acids
 - (B) nitrogen bases
 - (C) phosphates
 - (D) sugars
58. Which is a frameshift mutation?
- (A) deletion
 - (B) mis-sense
 - (C) nonsense
 - (D) silent

59. If a point mutation occurred in the nucleotide sequence ACT GCC ATT GCC, which would represent a possible new code?
- (A) ACA GCC ATT GCC
 - (B) ATT GCC GCC ACT
 - (C) CCG TTA CCG TCA
 - (D) GCC ACT ATT GCC
60. If a female is born with a single X chromosome, what genetic disorder does she most likely have?
- (A) Down syndrome
 - (B) Jacobs syndrome
 - (C) Klinefelter syndrome
 - (D) Turner syndrome
61. Which genetic disorder is caused by co-dominant inheritance?
- (A) hemophilia
 - (B) muscular dystrophy
 - (C) progeria
 - (D) sickle cell anemia
62. On what basis does gel electrophoresis sort molecules?
- (A) electric charge and mass
 - (B) electric charge and nucleotide sequence
 - (C) mass only
 - (D) nucleotide sequence only
63. Which is the most significant finding of the Human Genome Project?
- (A) *Homo neanderthalis* evolved into *Homo sapiens*.
 - (B) Human genes support the Gaia theory.
 - (C) It verified the One Gene - One Polypeptide hypothesis.
 - (D) There are much fewer human genes present than expected.
64. Which improves an organism's ability to survive and reproduce in its environment?
- (A) adaptation
 - (B) convergence
 - (C) divergence
 - (D) embryology
65. Who proposed a theory of evolution identical to Darwin?
- (A) Cuvier
 - (B) Lamarck
 - (C) Lyell
 - (D) Wallace
66. Which idea was included in Lamarck's theory of evolution?
- (A) acquired characteristics
 - (B) incomplete dominance
 - (C) population variation
 - (D) spontaneous generation

67. What evidence for the modern theory of evolution is supported by vestigial organs?
- (A) biogeography
 - (B) comparative anatomy
 - (C) fossil record
 - (D) molecular biology
68. A fossil is found to contain $\frac{1}{8}$ of the original carbon-14. How old is the fossil if the half-life of carbon-14 is 5 730 years?
- (A) 716 years
 - (B) 2 865 years
 - (C) 11 460 years
 - (D) 17 190 years
69. Which process occurs only by chance?
- (A) adaptive radiation
 - (B) artificial selection
 - (C) genetic drift
 - (D) natural selection
70. What is the main source of variation in a population?
- (A) DNA replication
 - (B) environment
 - (C) evolution
 - (D) mutation
71. In which area would the founder effect most likely occur?
- (A) forest
 - (B) grassland
 - (C) island
 - (D) ocean
72. Which evolutionary mechanism would best explain how a population of randomly mating individuals would have the following genotypic ratio?
- $$AA = 0.05 \quad Aa = 0.75 \quad aa = 0.2$$
- (A) directional selection
 - (B) gene flow
 - (C) genetic drift
 - (D) stabilizing selection
73. Which type of isolation best describes how Newfoundland pine marten became different from Labrador pine marten?
- (A) behavioural
 - (B) geographic
 - (C) physiological
 - (D) temporal

74. Which explains the similarity between bat wings and butterfly wings?
- (A) adaptive radiation
 - (B) co-evolution
 - (C) convergent evolution
 - (D) divergent evolution
75. Which theory would be supported by a study that shows life on Earth originated from living bacterial cells that travelled from outer space on meteorites?
- (A) Gaia
 - (B) Intelligent Design
 - (C) panspermia
 - (D) symbiogenesis

Value

2% 77.(a) Explain either two reasons for supporting or two reasons for opposing the use of therapeutic cloning to replace damaged cells in the spinal cord.

2% (b) Two female athletes were administered testosterone to improve athletic performance. One athlete had gone through puberty while the other had not. How would the reproductive systems of the two athletes be affected differently by the administration of testosterone?

Value

3% 78.(b) In guinea pigs, black coat colour (B) is dominant to white (b), and short hair length (S) is dominant to long (s). A male guinea pig, black with short hair, mates with two females. The matings are described below.

female	phenotype of female	phenotypes of offspring produced
A	white, short-haired	black, short haired white, long-haired
B	black, short-haired	all white, long-haired

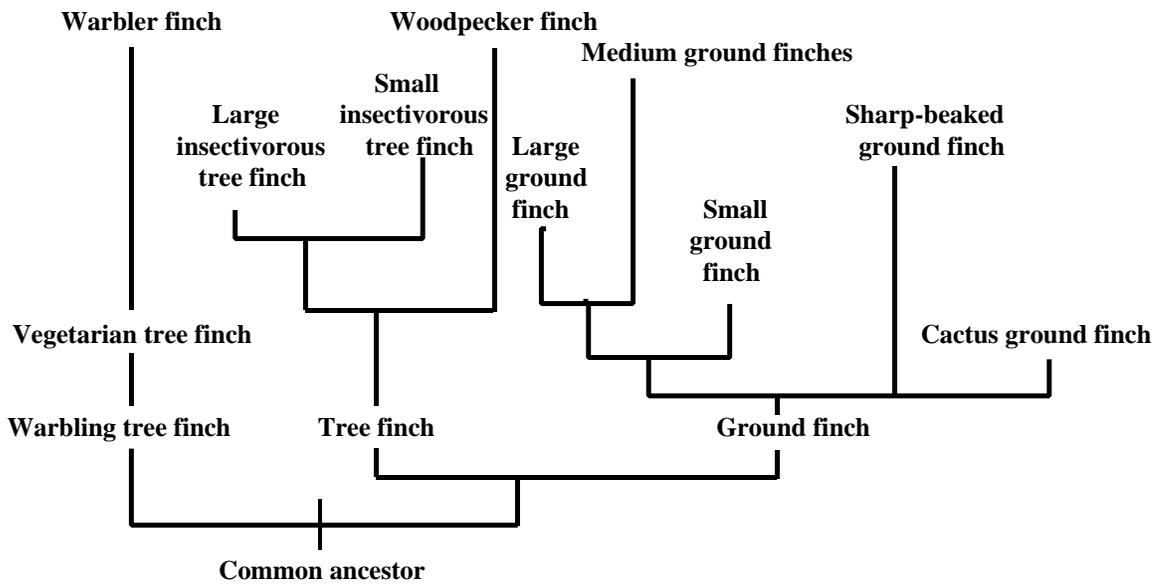
What are the genotypes of the male parent and each female parent? Show all workings.

male genotype: _____ female A genotype: _____ female B genotype: _____

2% (c) The island of Newfoundland is an attractive location for genetic research studies. How would a substantial influx of new families into the island affect further research by these companies?

Value

79.(b) The diagram below shows how the Galapagos Island finches evolved from one common ancestor.



1%

(i) What mechanism of evolution is illustrated in this diagram?

1%

(ii) Give two possible reasons for the occurrence of this pattern of evolution.
