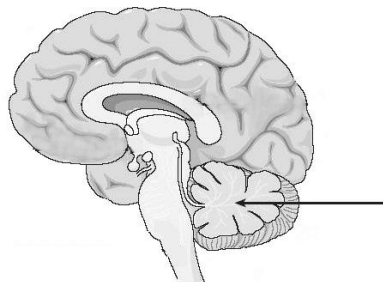


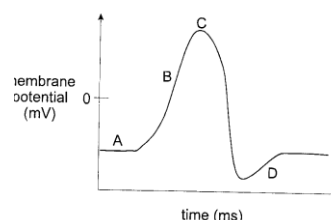
PART I
Total Value: 75%

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

1. Which part of the brain controls muscle coordination?
(A) cerebellum
(B) cerebrum
(C) medulla oblongata
(D) midbrain
2. Which part of the nervous system is made up of the brain and spinal cord?
(A) central
(B) parasympathetic
(C) peripheral
(D) sympathetic
3. Which part of the nervous system includes the parasympathetic nervous system?
(A) central
(B) peripheral
(C) somatic
(D) sympathetic
4. Which structure protects the brain?
(A) hypothalamus
(B) medulla
(C) meninges
(D) pons
5. Which part of the nervous system is responsible for the body returning to a normal state of homeostasis after a frightening event?
(A) central
(B) parasympathetic
(C) peripheral
(D) sympathetic
6. Which structure directly controls a person's ability to think about a question and answer it correctly?
(A) A
(B) B
(C) C
(D) D



7. Which indicates that the sodium-potassium pump is repolarizing the membrane?
(A) A
(B) B
(C) C
(D) D
8. Which describes the movement of ions by the sodium-potassium pump?
(A) less sodium out than potassium in
(B) more sodium out than potassium in
(C) same sodium in as potassium out
(D) same sodium out as potassium in



9. A hydra is a freshwater invertebrate. If adding one drop of dilute hydrochloric acid to the water surrounding the hydra causes it to contract, what role does the acid play in the response?
- (A) impulse
 - (B) neurotransmitter
 - (C) response
 - (D) stimulus
10. What type of compounds are acetylcholine and dopamine?
- (A) depressants
 - (B) neurotransmitters
 - (C) poisonous drugs
 - (D) stimulants
11. Which neurotransmitter has an excitatory effect on skeletal muscle, but an inhibitory effect on cardiac muscle?
- (A) acetylcholine
 - (B) glutamate
 - (C) noradrenaline
 - (D) serotonin
12. A researcher used electrical stimulation of a neuron to cause a response in muscle tissue and collected the data below. What can be concluded from this experiment?

Electronic Stimuli (mV)	Muscle Response
10	None
20	None
30	None
40	Contraction
50	contraction

	Stimulation	Response
(A)	Above threshold	Contraction
(B)	Above threshold	Mild response
(C)	Below threshold	Contraction
(D)	Below threshold	Mild response

13. Which takes information from sense organs and brings it to the central nervous system?
- (A) autonomic
 - (B) interneuron
 - (C) motor neuron
 - (D) sensory neuron
14. Which is the most common inhibiting neurotransmitter of the brain?
- (A) GABA
 - (B) glutamate
 - (C) noradrenaline
 - (D) serotonin
15. Which action tests for the Babinski reflex?
- (A) drawing a pointy object across the knee cap
 - (B) drawing a pointy object across the sole of the foot
 - (C) striking the tendon below the knee cap
 - (D) striking the tendon on back of the foot
16. Which occurs if a dendrite is blocked from allowing the uptake of sodium ions?
- (A) Acetylcholine will not produce an action potential.
 - (B) Cholinesterase will not be released into the synapse.
 - (C) Dopamine levels will rise in the skeletal muscles.
 - (D) Glutamate concentrations will be greater in the cerebral cortex.

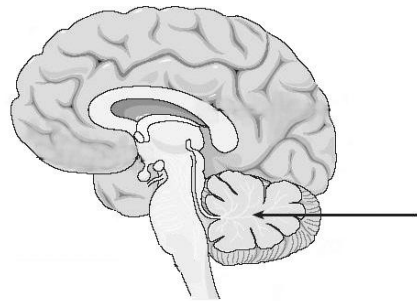
17. Which medical technology would most likely be used to diagnose a patient suspected to have a cancerous tumour on their lung?
- (A) CAT
 - (B) EEG
 - (C) EKG
 - (D) MRI

18. What part of a neuron carries nerve impulses towards the cell body?
- (A) axon
 - (B) dendrite
 - (C) myelin sheath
 - (D) Schwann cell

19. Which statement best illustrates homeostasis?
- (A) A constant internal environment is maintained regardless of external change.
 - (B) Eyes, ears and nose provide information about the external environment.
 - (C) Sensory receptors provide data about whether the body is gaining or losing heat.
 - (D) The internal environment of an organism is the same as the external environment.

20. Which structure below controls balance?

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



21. Which occurs immediately after an action potential?

- (A) all or none response
- (B) refractory period
- (C) resting potential
- (D) threshold

22. Which sequence occurs after an individual touches a hot object?

- (A) receptor → interneuron → motor neuron → sensory neuron → effector
- (B) receptor → interneuron → sensory neuron → motor neuron → effector
- (C) receptor → sensory neuron → interneuron → motor neuron → effector
- (D) receptor → sensory neuron → motor neuron → interneuron → effector

23. Which is the correct match for a decrease in neurotransmitter production and the disease that results?

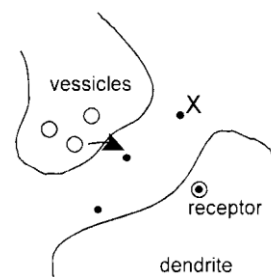
<u>Neurotransmitter</u>	<u>Disease</u>
(A) acetylcholine	Huntington's Disease
(B) dopamine	Parkinson's Disease
(C) GABA	meningitis
(D) serotonin	multiple sclerosis

24. Which technology measures the electrical activity of the functioning brain and can be used to diagnose epilepsy?

- (A) CAT
- (B) EEG
- (C) MRI
- (D) PET

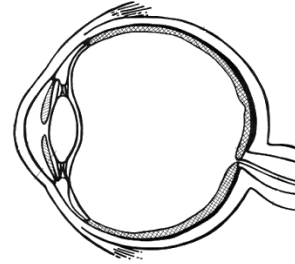
25. The diagram below shows portions of two neurons in a person's brain. If a stimulus has reached the synapse, which is most likely represented by X?

- (A) acetylcholine
- (B) cholinesterase
- (C) dopamine
- (D) norepinephrine



26. Which drug is classified as a depressant?
 (A) alcohol
 (B) caffeine
 (C) ecstasy
 (D) nicotine
27. What is the correct order of the path of light through the eye?
 (A) cornea → lens → vitreous humor → pupil → retina
 (B) cornea → pupil → lens → vitreous humor → retina
 (C) lens → pupil → cornea → vitreous humor → retina
 (D) retina → vitreous humor → lens → pupil → cornea

28. Which part of the eye contains rods and cones?
 (A) A
 (B) B
 (C) C
 (D) D



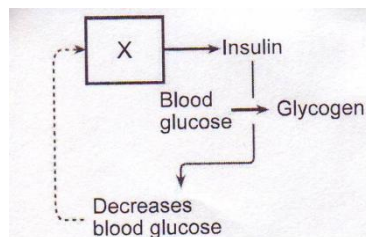
29. Which pathway illustrates a reflex arc?
 (A) brain → spinal cord → hand → sensory neuron
 (B) hand → sensory neuron → spinal cord → motor neuron
 (C) interneuron → stimuli → sensory neuron → motor neuron
 (D) motor neuron → interneuron → stimuli → sensory neuron
30. What symptoms are shown by a person with low levels of cerebral cortex dopamine?
 (A) blurred vision, seizures, slurred speech
 (B) headache, fever, stiff neck
 (C) memory loss, confusion, impaired judgement
 (D) tremors, stiffness in limbs, slow movements
31. Which disease of the human eye is caused by a buildup of aqueous humour between the lens and the cornea?
 (A) astigmatism
 (B) cataract
 (C) glaucoma
 (D) myopia
32. Which carries vibrations through the middle ear?
 (A) auditory canal
 (B) cochlea
 (C) ossicles
 (D) pinna
33. Which hormone is released from the pineal gland?
 (A) ADH
 (B) FSH
 (C) melatonin
 (D) oxytocin
34. When going through puberty, how does testosterone put hair on a boy's chest?
 (A) creates a second messenger
 (B) effects cells to change shape
 (C) interacts with DNA in the nuclei of cells
 (D) triggers nerve impulses in cells
35. Which hormones are produced in the adrenal gland?
 (A) ADH and FSH
 (B) aldosterone and cortisol
 (C) GH and GnRH
 (D) oxytocin and thymosin

36. What is the target organ for the hormone insulin?
 (A) adrenal cortex
 (B) heart
 (C) kidney
 (D) liver
37. A tumour detected on the thyroid gland inhibits thyroid function. What is the effect on thyroxin and thyroid-stimulating hormone (TSH)?
- | | <u>Thyroxin</u> | <u>TSH</u> |
|-----|-----------------|------------|
| (A) | low | high |
| (B) | low | low |
| (C) | high | high |
| (D) | high | low |
38. Which type of hormone penetrates target cells to combine with genes to produce proteins?
 (A) ACTH
 (B) carbohydrates
 (C) non-steroids
 (D) steroids
39. Which disease is caused by an excessive production of thyroxine by the thyroid gland?
 (A) diabetes mellitus
 (B) gigantism
 (C) hyperthyroidism
 (D) hypothyroidism
40. Which is directly involved in the action of most non-steroid based hormones?
 (A) permeable membrane
 (B) prostaglandins
 (C) second messenger
 (D) testosterone
41. Which hormones have antagonistic effects?
 (A) epinephrine and ADH
 (B) insulin and glucagon
 (C) thyroxine and calcitonin
 (D) thyroxine and parathyroid hormone
42. Which describes the blood hormone concentration of a person who has not eaten for 24 hours?
 (A) high insulin, high glucagon
 (B) high insulin, low glucagon
 (C) low insulin, high glucagon
 (D) low insulin, low glucagon
43. Which hormone raises blood sugar?
 (A) adrenaline
 (B) glucagon
 (C) insulin
 (D) thyroxine
44. A person has a swollen neck and experiences fatigue and weight gain. Which would a physician most likely recommend as appropriate treatment?
 (A) increasing dietary intake of calcium
 (B) increasing dietary intake of iodine
 (C) taking insulin injections
 (D) taking vitamin D pills

45. Which hormone stimulates the sympathetic nervous system?
 (A) adrenaline
 (B) glucagon
 (C) somatotropin
 (D) thyroxine
46. Which hormone would a doctor most likely give to an expectant mother to stimulate uterine contractions and induce labour?
 (A) insulin
 (B) oxytocin
 (C) prolactin
 (D) thyroxine
47. Which endocrine gland releases thyroxine?
 (A) adrenal
 (B) hypothalamus
 (C) pineal
 (D) thyroid
48. Why might a doctor prescribe exposure to sunlight for a person experiencing symptoms of depression and an overwhelming desire for sleep?
 (A) decrease melatonin levels
 (B) decrease somatotropin levels
 (C) increase acetylcholine levels
 (D) increase thyroxine levels
49. Which hormone triggers the cellular release of glucose, fatty acids, and amino acids into the bloodstream?
 (A) glucagon
 (B) insulin
 (C) melatonin
 (D) thyroxine

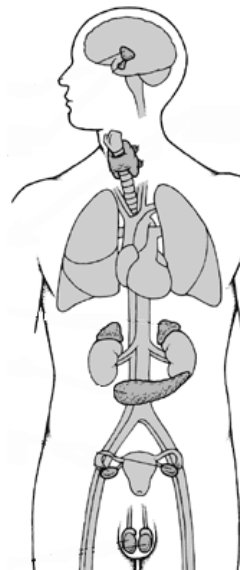
50. Which gland is represented by X?

- (A) adrenal medulla
 (B) pancreas
 (C) posterior pituitary
 (D) thyroid



51. In the diagram below, which gland illustrates how the nervous and endocrine systems work together?

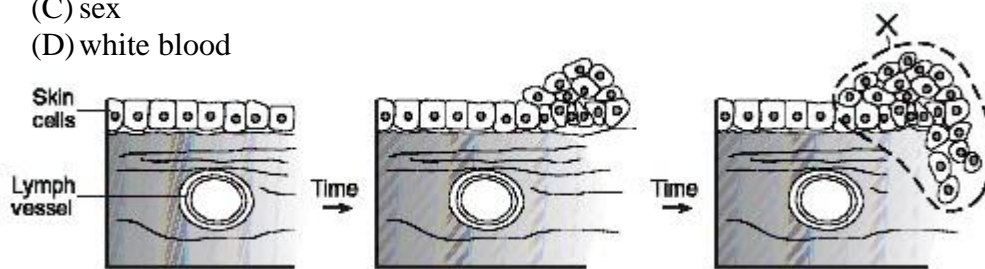
- (A) A
 (B) B
 (C) C
 (D) D



52. A boy entering grade one is 1.5 m tall and in grade three he is 2.0 m tall. If the other grade three children are 1.2 m tall, which hormone is overactive in this boy?
- (A) cortisol
 - (B) glucagon
 - (C) somatotropin
 - (D) testosterone
53. What are chromatids?
- (A) bacterial chromosomes
 - (B) dense patches within the nucleus
 - (C) duplicate copies of a chromosome
 - (D) prokaryotic nuclei
54. Why might a doctor suggest radiation as the best treatment option for a patient diagnosed with a localized cancerous tumour?
- (A) can be administered at home
 - (B) has no side effects
 - (C) is focused on the affected area only
 - (D) will affect all of the body cells
55. What is true of a clone?
- (A) has different chromosome numbers
 - (B) is produced by meiosis
 - (C) is produced by mitosis
 - (D) results from sexual reproduction
56. How are human sperm and eggs similar?
- (A) both are produced in equal numbers
 - (B) both are the same size
 - (C) both have motility
 - (D) both have the same number of chromosomes
57. Why might stem cells have the potential to decrease Parkinson's symptoms?
- (A) They can become neurons that produce dopamine in the brain.
 - (B) They cause existing brain cells to produce dopamine.
 - (C) They decrease the amount of dopamine reducing enzymes.
 - (D) They increase the effectiveness of dopamine receptors in the brain.
58. If the DNA per cell is measured during each stage of meiosis, which represents the ratio of DNA in prophase I to the DNA in prophase II?
- | | <u>Prophase I</u> | <u>Prophase II</u> |
|-----|-------------------|--------------------|
| (A) | 1 | 2 |
| (B) | 1 | 4 |
| (C) | 2 | 1 |
| (D) | 4 | 1 |
59. During which stage of meiosis do homologous chromosomes pair up?
- (A) anaphase I
 - (B) anaphase II
 - (C) prophase I
 - (D) prophase II
60. Why must chromosome number be reduced by half during the production of sex cells?
- (A) limit the number of gametes produced
 - (B) maintain chromosome number from generation to generation
 - (C) minimize the probability of genetic disorders
 - (D) provide genetic information for producing new offspring

61. When mitosis occurs in onion root tip cells, a cell plate develops following telophase. How is animal cell mitosis different?
- (A) Cell membrane pinches inward.
 (B) Chromosomes separate in pairs.
 (C) Four cells are formed rather than two.
 (D) Two nuclei are formed.
62. An organism produces gametes with 16 chromosomes. How many chromosomes would be found in a normal body cell?
- (A) 4
 (B) 8
 (C) 16
 (D) 32

63. The diagram below shows the growth pattern of some human skin cells after they have been exposed to ultraviolet radiation. What type of cells are most likely found in area X?
- (A) cancer
 (B) red blood
 (C) sex
 (D) white blood



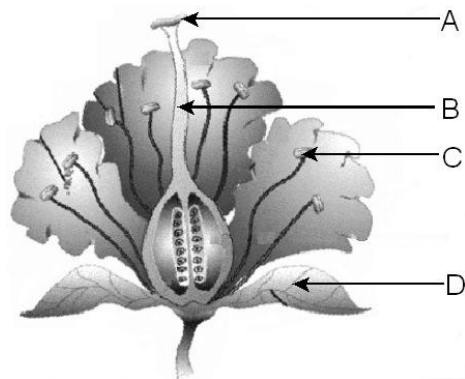
64. Which phase of mitosis is characterized by the arrangement of all chromosomes along the equator of the cell?
- (A) anaphase
 (B) metaphase
 (C) prophase
 (D) telophase
65. When does separation of the homologous chromosomes occur?
- (A) fertilization
 (B) meiosis I
 (C) meiosis II
 (D) mitosis

66. Which is true of oogenesis and spermatogenesis?

<u>Oogenesis</u>	<u>Spermatogenesis</u>
(A) equal cell division	unequal cell division
(B) occurs in males	occurs in females
(C) one egg cell produced	four sperm cells produced
(D) produces motile cells	produces non-motile cells

67. A biologist successfully fertilized an egg cell with two sperm cells forming a zygote. Later study of the zygote showed that it contained 27 chromosomes. How many chromosomes should normally be found in diploid cells of this organism?
- (A) 9
 (B) 18
 (C) 27
 (D) 36
68. Which part of human sperm contains high numbers of mitochondria that provide the energy for movement?
- (A) acrosome
 (B) flagellum
 (C) middle piece
 (D) nucleus

69. A tree produces only seedless oranges. A small branch cut from this tree produces roots after it is planted in soil. What type of fruit will most likely be produced when this tree matures?
- (A) a majority of oranges with seeds
 - (B) a majority of seedless oranges
 - (C) only oranges with seeds
 - (D) only seedless oranges
70. A queen bee can produce offspring without contribution of sperm. What is this mode of reproduction?
- (A) binary fission
 - (B) budding
 - (C) parthenogenesis
 - (D) spore production
71. Which structures aid in the transport of sperm nuclei to egg nuclei in most flowering plants following pollination?
- (A) anthers
 - (B) filaments
 - (C) pollen tubes
 - (D) sepals
72. In which part of the flower does both meiosis and fertilization occur?
- (A) anther
 - (B) filament
 - (C) ovule
 - (D) stigma
73. Which structure is part of the male sex organ?
- (A) A
 - (B) B
 - (C) C
 - (D) D



74. Where are sperm produced?
- (A) interstitial cells
 - (B) pituitary gland
 - (C) seminiferous tubules
 - (D) testes wall
75. In which structure are human sperm cells matured and stored until release?
- (A) accessory glands
 - (B) epididymis
 - (C) prostate
 - (D) seminiferous tubules

PART II

Total Value: 25%

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

2% 76.(a) Describe one advantage and one disadvantage of a reflex arc response as compared to a normal response from the brain.

2% (b) Neurotransmitter levels in the brain have been linked to clinical depression. What is the biological basis for this relationship?

2%(c) State two reasons why “designer drugs” are more dangerous than prescription drugs.

3% (d) Some cell phones have ring tones with high frequencies that can be heard by adolescents but not by older adults.

i) Explain two biological reasons for this difference.

ii) Most newer cell phones can be used as a personal listening device. Explain why the use of personal listening devices, played at high volumes for prolonged periods, should be discouraged in adolescents?

3% (e) A researcher surgically removes the Islets cells from a rat's pancreas to observe the effects.

i) Describe two symptoms the rat should start exhibiting after the surgery.

ii) Explain one way the researcher could treat these symptoms.

3% (f) Explain how the nervous and endocrine systems work together when the body responds to a dangerous situation.

4% 77. (a) Eggs were fertilized through *in vitro* fertilization. After the eggs were frozen and stored for a few years, the donor couple no longer required them for fertility purposes and decided to donate them to science.

(i) Why are these embryonic cells valuable to scientists?

(ii) Describe two ways these cells are used by scientists.

2% (b) The diagram below shows a cell with two pairs of homologous chromosomes, (R₁, R₂ and S₁, S₂). Draw all possible daughter cells produced by the meiotic division of this cell and label the chromosomes in each daughter cell. (Assume no crossing over occurs)

2% (c) Describe two ways in which the human population would most likely change if the only form of human reproduction was asexual?

2% (d) How do the roles of the generative and tube nuclei differ in pollination and fertilization?