PART I
Total Value: 75%

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

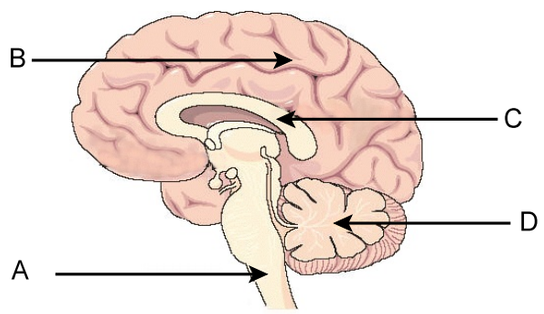
1. In which part of the brain is all the information from our senses sorted and interpreted?

   (A) cerebellum
   (B) cerebrum
   (C) medulla oblongata
   (D) midbrain

2. Which would receive information from a sensory neuron?

   (A) brain
   (B) gland
   (C) muscle
   (D) receptor

3. Which structure has been damaged if a needle being put into the arm of a stroke patient cannot be felt by the patient?



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

4. Which causes the pituitary gland to release a hormone?

   (A) motor neuron
   (B) muscle effector
   (C) pain receptor
   (D) reflex response

5. Which neurotransmitter elevates mood and controls skeletal muscles?

   (A) dopamine
   (B) glutamate
   (C) noradrenaline
   (D) oxytocin

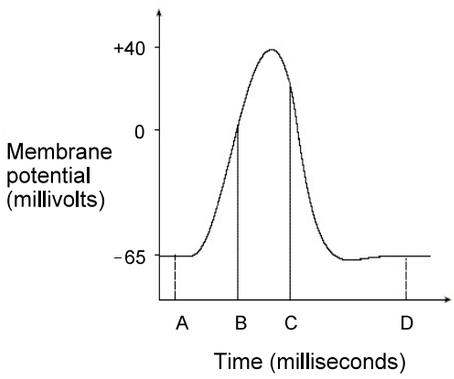
6. Which is caused by the gradual death of the neurons that produce dopamine?

   (A) Alzheimer's disease
   (B) meningitis
   (C) multiple sclerosis
   (D) Parkinson's disease

7. Which hormone might a doctor give to an expectant mother to stimulate uterine contractions and induce labour?

(A) insulin
(B) oxytocin
(C) prolactin
(D) thyroxine

8. The data below were collected by a micro-electrode implanted in the membrane of a neuron. Which represents the point at which the potassium ion concentration inside the cell membrane is lowest?



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

9. 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

10. Which medical procedure would most likely be used if a patient were diagnosed with cataracts?

(A) contact lenses
(B) corneal transplant
(C) laser surgery
(D) lens replacement

11. Which is most typical of nerve deafness?

(A) It is caused by damage to the eardrum or ossicles.
(B) It is caused by damage to the hair cells in the cochlea.
(C) It is more common in younger people.
(D) It results in loss of balance and coordination.

12. How do eustachian tube implants help chronic middle ear infections?

(A) allow sound conduction to improve in the tympanic membrane
(B) allow the release of excess fluid from behind the eardrum
(C) reduce balance problems associated with an infection of the semi-circular canals
(D) reduce pressure on the cochlea allowing it to function correctly

13. Which endocrine gland releases thyroxin?

(A) adrenal
(B) hypothalamus
(C) pineal
(D) thyroid

14. Which hormone triggers the cellular release of glucose, fatty acids, and amino acids into the bloodstream?

(A) glucagon
(B) insulin
(C) melatonin
(D) thyroxine

15. 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

16. Which phase of meiosis is illustrated in the diagram below?

(A) anaphase I
(B) anaphase II
(C) metaphase I
(D) metaphase II

17. What is the end result of crossing over during meiosis?

(A) greater number of gametes produced
(B) greater variety among the gametes produced
(C) less number of gametes produced
(D) less variety among the gametes produced

18. How many spermatogonia must undergo meiosis to produce 200 000 sperm cells?

(A) 50 000
(B) 100 000
(C) 200 000
(D) 400 000

19. Why is the human egg cell much larger than the human sperm cell?

(A) Eggs contain more chromosomes than sperm.
(B) Sperm have flagella for locomotion.
(C) Unequal division of cytoplasm occurs during oogenesis.
(D) Unequal division of cytoplasm occurs during spermatogenesis.

20. How is the stigma adapted for fertilization in flowering plants?

(A) gives off odors to attract pollinators
(B) has sticky surface to hold pollen
(C) produces large number of pollen
(D) surrounds and protects the flower bud

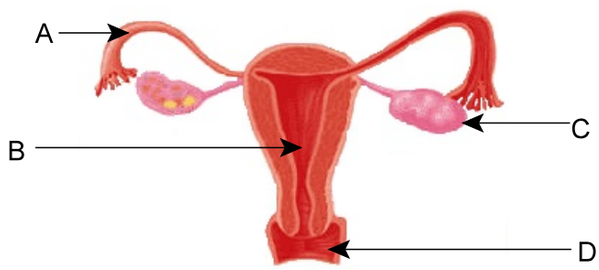
21. Which organism is capable of asexual reproduction by spores?

(A) amoeba
(B) bread mold
(C) earthworm
(D) hydra

22. Which reproductive hormone serves a similar function in males and females?

(A) follicle stimulating hormone
(B) inhibin
(C) progesterone
(D) testosterone

23. In which structure does fertilization normally occur?



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

24. Which best describes the corpus luteum?

(A) early embryo
(B) menstrual discharge
(C) placental tissue
(D) ruptured follicle

25. Which sexually transmitted infection is caused by a bacterium and can lead to mental illness and blindness?

(A) AIDS
(B) chlamydia
(C) gonorrhea
(D) syphilis

26. What is the most likely cause of male infertility?

(A) high sperm count
(B) high sperm motility
(C) obstruction in the vas deferens
(D) urinary tract infection

27. A male receives radiation therapy and becomes sterile. If he later marries a fertile woman and they conceive a child, what type of technology did they most likely use?

(A) artificial insemination and surrogate motherhood
(B) cryopreservation and artificial insemination
(C) in vitro fertilization and adoption
(D) in vitro fertilization and superovulation

28. Which shows the path of a sperm from its origin until fertilization?

(A) epididymis → vas deferens → oviduct → uterus
(B) epididymis → vas deferens → uterus → oviduct
(C) vas deferens → epididymis → oviduct → uterus
(D) vas deferens → epididymis → uterus → oviduct

29. In which stage of embryonic development has cell differentiation occurred?

(A) blastocyst
(B) morula
(C) neurula
(D) trophoblast

30. Which primary membrane is involved with gas exchange?

(A) allantois
(B) amnion
(C) chorion
(D) yolk

31. Which is true of cleavage?

(A) cell division occurs
(B) differentiation begins
(C) implantation occurs
(D) zygote grows larger in size

32. Which stage of childbirth involves the umbilical cord being completely eliminated from the uterus?

(A) delivery
(B) dilation
(C) expulsion
(D) placental

33. Which supports the positive feedback loop involving oxytocin and breast feeding?

(A) oxytocin causes uterine muscles to contract
(B) oxytocin levels are monitored by the thyroid gland
(C) suckling inhibits oxytocin release
(D) suckling stimulates oxytocin release

34. Which method of studying embryonic development uses sound waves and is non-invasive?

(A) amniocentesis
(B) chorionic villi sampling
(C) fetoscopy
(D) ultrasound

35. Scientists intentionally placed endoderm tissue in the ectoderm of a developing embryo. Which experimental result are they most likely investigating?

(A) growth of gonad tissue in the kidney
(B) growth of gonad tissue in the skin
(C) growth of lung tissue in the kidney
(D) growth of lung tissue in the skin

36. What are Mendel's unit characters known as today?

(A) chromosomes
(B) genes
(C) genotypes
(D) phenotypes

37. What are all possible gametes that would be produced from parent 1 with genotype TtRr and parent 2 with genotype Ttrr?

	Parent 1	Parent 2
(A)	TR, tr	Tr, tr
(B)	TR, Tr, tR, tr	Tr, tr
(C)	Tt, Rr	Tt, rr
(D)	TT, RR, tt, rr	Tt, rr

38. In fruit flies, long wing is dominant to short wing. A cross between heterozygous long winged flies produces 1000 offspring. According to Mendelian ratios, how many of the offspring would be heterozygous long winged?

(A) 0
(B) 250
(C) 500
(D) 1000

39. Purple flowers are dominant to white flowers in pea plants. If a homozygous dominant plant is crossed with a recessive plant, what is the phenotypic ratio in the offspring?

(A) ½ purple, ½ white
(B) ¾ purple, ¼ white
(C) all purple
(D) all white

40. An organism has genotype Xx Yy zz. How many gamete combinations can be produced from this organism?

(A) 2
(B) 4
(C) 8
(D) 16

41. Why would a single-trait test cross produce offspring that all have the dominant phenotype?

(A) Alleles are co-dominant.
(B) Both parents are heterozygous.
(C) Parent with the dominant phenotype is heterozygous.
(D) Parent with the dominant phenotype is homozygous.

42. Flower colour in snap dragons is an example of incomplete dominance. The heterozygous condition results in pink colour. What is the phenotypic ratio resulting from a cross between two pink flowers?

(A) 50% pink, 25% red, 25% white
(B) 50% red, 50% white
(C) 75% red, 25% white
(D) 100% red

43. A man with type O blood and a woman with type A blood are expecting a child. Both the man and the woman's fathers have type B blood. What is the probability of the child having type O blood?

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

44. Whose observations formed the basis for the chromosome theory of inheritance?

(A) Franklin and Wilkins
(B) Hershy and Chase
(C) Sutton and Boveri
(D) Watson and Crick

45. Two traits studied in pea plants are flower colour and plant height. If both of these traits are located on the same chromosome, what is true of the F_2 generation?

(A) All offspring will be heterozygous for both traits.
(B) All offspring will show the dominant traits.
(C) Variation in offspring will be decreased.
(D) Variation in offspring will be increased.

46. Which is an example of polygenic inheritance in humans?

(A) blood type
(B) colour blindness
(C) height
(D) tongue rolling

47. Which is a reason sex-linked defects are more common in males than females?

(A) A daughter could receive either an X or a Y from the father.
(B) A father can pass on his defect only to his son.
(C) A mother must display the defect in order to pass it on to a daughter.
(D) A son has to inherit only one recessive allele to show the defect.

48. If a mother is a carrier for the recessive sex-linked disorder hemophilia, and her husband has the normal dominant allele, what percentage of their children will have hemophilia?

(A) 50% of daughters
(B) 50% of sons
(C) 100% of daughters
(D) 100% of sons

49. How is information organized in DNA?

(A) sequence of amino acids
(B) sequence of nucleotides
(C) types of phosphate groups
(D) types of sugars

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**

50. Using the RNA codon table above, which is the peptide sequence produced through transcription if the codon sequence was GUG CCC UGG?

(A) glycine - proline - valine
(B) tryptophan - proline - valine
(C) valine - proline - stop
(D) valine - proline - tryptophan

51. During DNA replication, which process involves the addition of complementary nucleotides to the original DNA strand?

(A) elongation
(B) initiation
(C) proofreading
(D) termination

52. Which best describes an RNA molecule?

	Base	Structure
(A)	thymine	double stranded
(B)	thymine	single stranded
(C)	uracil	double stranded
(D)	uracil	single stranded

53. If a mRNA segment has the sequence AAU UUC GGC, what is the sequence of the original DNA?

(A) AAT TTC GGC
(B) TTA AAG CCG
(C) TTU UUG CCG
(D) UUA AAG CCG

54. Scientists are developing a new class of drugs to treat hepatitis B which interfere with the ability of the virus to produce DNA polymerase. What effect would these drugs have on DNA replication?

(A) DNA helix will be unable to unwind.
(B) Nucleotides will be unable to bond to complementary bases.
(C) Okazaki fragments will not join together.
(D) tRNA will not join to the ribosome.

55. What is the function of tRNA during protein synthesis?

(A) attach mRNA to the ribosome
(B) deliver amino acids to the ribosome
(C) proofread the DNA template
(D) terminate translation

56. Increased exposure to which factor will increase the occurrence of mutations?

(A) high air pressure
(B) high humidity
(C) oxygen
(D) ultraviolet rays

57. Which is a result of monosomy?

(A) Down syndrome
(B) Jacobs syndrome
(C) Kleinfelter syndrome
(D) Turner syndrome

58. In which situation could a mutation be passed on to the offspring of an organism?

(A) A cell in the uterine wall of a human female undergoes a chromosomal alteration.
(B) A primary spermatocyte in a human forms a gamete containing 24 chromosomes.
(C) The DNA of a human lung cell is mutated.
(D) Ultraviolet radiation causes skin cells to undergo uncontrolled mitotic division.

59. Down syndrome is a disorder caused by nondisjunction. Which chromosome combination identifies Down syndrome?

	Total Chromosomes	Autosomes	Sex Chromosomes
(A)	46	45	1
(B)	46	44	2
(C)	47	45	2
(D)	47	44	3

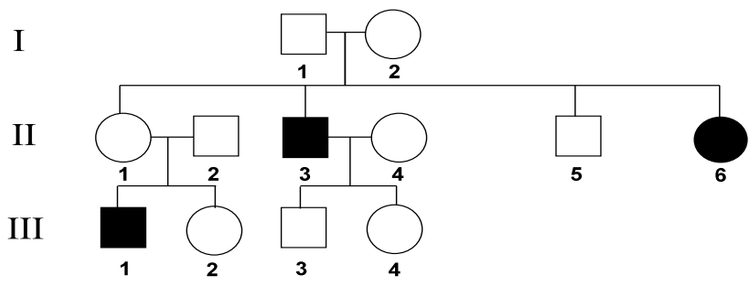
60. What is the inheritance pattern for Tay-Sachs disease?

(A) autosomal dominant
(B) autosomal recessive
(C) co-dominant
(D) incompletely dominant

61. Which two techniques are used to diagnose prenatal chromosomal abnormalities?

(A) amniocentesis and chorionic villi sampling
(B) fetoscopy and ultasound
(C) genetic counselling and genetic markers
(D) karyotyping and gel electrophoresis

62. The pedigree below is for a family affected by a rare genetic disorder. What type of inheritance is illustrated in the pedigree?



(A) autosomal dominant
(B) autosomal recessive
(C) sex-linked dominant
(D) sex-linked recessive

63. Which is an automated method of replicating DNA using repeated heating and cooling?

(A) DNA fingerprinting
(B) gel electrophoresis
(C) gene mapping
(D) polymerase chain reaction

64. What type of mutation occurs if the DNA sequence CCG TTT CGG changes to CCG TTC CGG?

(A) deletion
(B) frameshift
(C) insertion
(D) substitution

65. Which statement best describes evolution?

(A) a change in the characteristics of populations over generations
(B) a predictable change of characteristics from simple to complex in organisms
(C) causes organisms to develop characteristics they need
(D) proceeds from complex to simple organisms

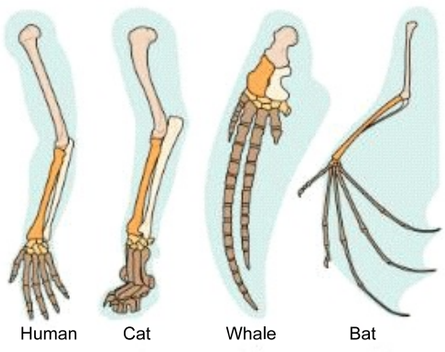
66. Which scientist would most likely state, “The long necks of the giraffe and stripes of the zebra are characteristics acquired in a few short generations as a result of evolution.”?

(A) Darwin
(B) Lamarck
(C) Mendel
(D) Wallace

67. According to Darwin, what could cause the observed differences in the beak structures of finches on the Galapagos Islands?

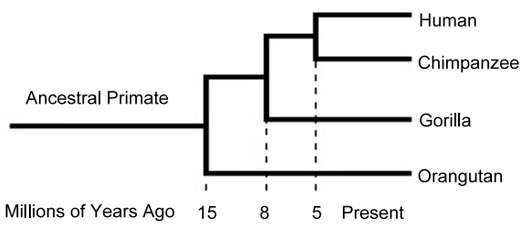
(A) acquired characteristics in the parent finches
(B) adaptations of the finches to different environments
(C) mating behaviour of the different finch species
(D) size of the island where the finches lived

68. Which evolutionary concept is illustrated in the diagram below?



(A) biochemical similarities
(B) embryological similarity
(C) homologous structures
(D) vestigial structures

69. Based on the diagram below, which organisms are most closely related?



(A) chimpanzee and gorilla
(B) gorilla and orangutan
(C) human and chimpanzee
(D) human and gorilla

70. A recessive trait appears in 81% of a population that is in Hardy-Weinberg equilibrium. What percentage of the population in the next generation will be heterozygous?

(A) 1 %
(B) 9 %
(C) 18 %
(D) 81 %

71. Which describes the condition when alleles move between local populations due to migration and subsequent interbreeding?

(A) gene drift
(B) gene flow
(C) gene frequency
(D) gene pool

72. The breeding of dogs for competition is an example of which type of selection?

(A) artificial
(B) directional
(C) natural
(D) stabilizing

73. Which process of evolution states that distantly related organisms can develop similar characteristics over time?

(A) congruent
(B) convergent
(C) divergent
(D) parallel

74. Who proposed that organic molecules could have originated from chemical evolution on early Earth?

(A) Hooker
(B) Miller
(C) Oparin
(D) Watson

75. Which is a similarity between Intelligent Design Theory and Panspermia Theory?

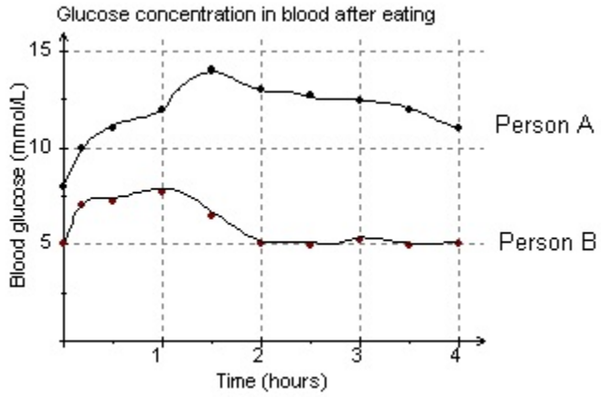
(A) belief in a supreme being as the originator of life on Earth
(B) belief that life did not start spontaneously on Earth
(C) use of Darwin's theory of evolution to support both theories
(D) use of Lamarck's theory of evolution to support both theories

PART II
Total Value: 25%

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

Value

3% 76.(a) Following a meal, blood glucose levels are monitored in two people over a period of 4 hours and the results are graphed below. Which person has diabetes mellitus? Explain.



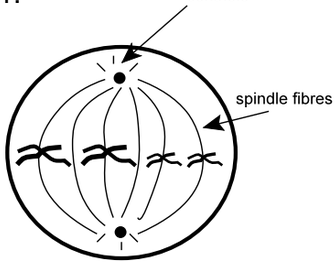
2% (b) State one way prescription drugs can be beneficial to society and one way they can be harmful to society.

Value

2% 77.(a) Due to positioning of the fetus, the umbilical cord becomes twisted and fails to function properly. State two possible problems this might cause for the fetus.

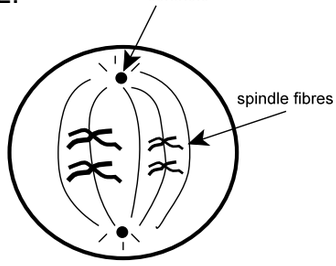
2% (b) In the diagrams below, cell 1 is undergoing mitosis and cell 2 is undergoing meiosis. Explain how the arrangement of chromosomes in each diagram affects the cells produced at the end of mitosis and meiosis.

Cell 1:



Metaphase (mitosis)

Cell 2:



Metaphase I (meiosis)

Value

3% 77.(c) A woman is suffering from irregular and painful menstrual periods. Her doctor prescribes birth control pills for this condition.

i) Explain how and why this treatment would be effective.

ii) What is a possible unwanted side effect of this treatment?

Value

3% 78.(a) The table below shows the gene pairs involved in determining eye colour. One pair codes for pigment in the front of the iris and the other for pigment in the back of the iris. If a man has grey-blue eyes and a woman has green eyes, use a Punnett square to determine which eye colour phenotypes would be possible for children born to this couple.

Genotype	Eye Colour
AA BB	black-brown
AA Bb	dark brown
AA bb	brown
Aa BB	brown-green flecked
Aa Bb	light brown
Aa bb	grey-blue
aa BB	green
aa Bb	dark blue
aa bb	light blue

Value

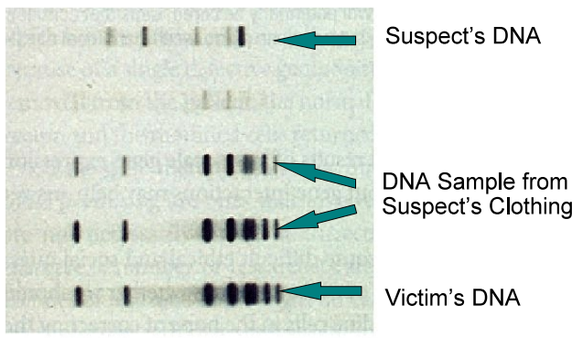
3% 78.(b) Current court cases have centered around ownership of individuals' DNA.

i) State two arguments against a company's right to sell an individual's DNA.

ii) Give a circumstance that might outweigh an individual's rights to ownership of DNA.

3% (c) The DNA fingerprint below shows DNA samples from a crime scene. The bands shown represent DNA from the victim and a suspect.

DNA Fingerprint



i) What technique was used to create this fingerprint?

ii) State a conclusion that can be made and explain how the fingerprint supports this conclusion.

Value

2% 79.(a) A radioactive isotope has a half-life of 5000 years. A recently discovered fossil contains ⅛ of the original isotope. Calculate the age of the fossil.

2% (b) State two ways that chance or accidental conditions may have played a role in the development of life on Earth.