

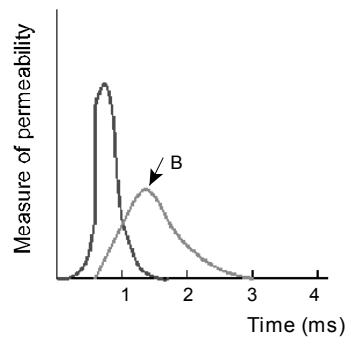
**PART I**  
**Total Value: 75%**

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

1. Which is the series of three membranes that surround and protect the central nervous system?
  - (A) corpus callosum
  - ✓(B) meninges
  - (C) skull
  - (D) spinal cord
  
2. Which takes information from sense organs and brings it to the central nervous system?
  - (A) autonomic
  - (B) interneuron
  - (C) motor neuron
  - ✓(D) sensory neuron
  
3. Which is the most common inhibiting neurotransmitter of the brain?
  - ✓(A) GABA
  - (B) glutamate
  - (C) noradrenaline
  - (D) serotonin
  
4. 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
  
5. During a frightening situation, which nervous system and endocrine gland work together to cause a body reaction?

	System	Gland
(A)	parasympathetic	adrenal
(B)	parasympathetic	thyroid
✓(C)	sympathetic	adrenal
(D)	sympathetic	thyroid
  
6. 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.

7. The graph below shows a neuron following stimulation. Which ion is represented at point B?



- (A) calcium  
 (B) chloride  
 (C) potassium  
 (D) sodium
8. 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

9. Which part of the human eye contains the rods and the cones?

- (A) cornea  
 (B) iris  
 (C) pupil  
 (D) retina

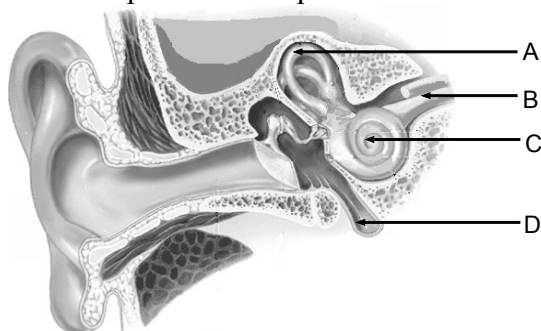
10. Which vision disorder **cannot** be improved by wearing corrective lenses?

- (A) astigmatism  
 (B) glaucoma  
 (C) hyperopia  
 (D) myopia

11. Which carries vibrations through the middle ear?

- (A) auditory canal  
 (B) cochlea  
 (C) ossicles  
 (D) pinna

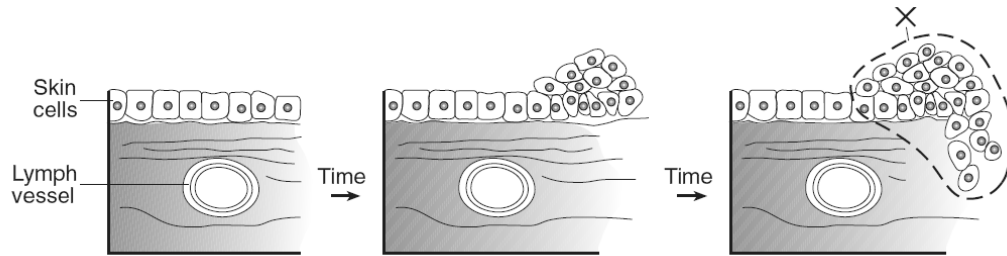
12. Which structure allows air pressure to equalize?



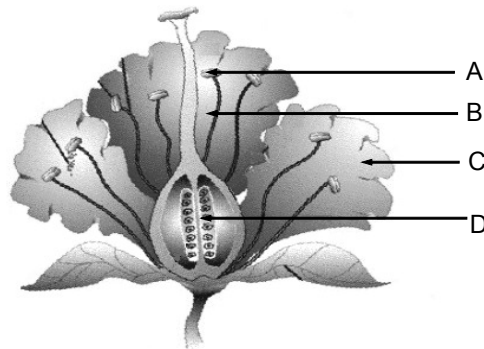
- (A) A  
 (B) B  
 (C) C  
 (D) D

13. Which gland is located deep in the centre of the brain?
- (A) adrenal
  - ✓(B) pineal
  - (C) pituitary
  - (D) thymus
14. Which hormone regulates sugar uptake by cells?
- ✓(A) insulin
  - (B) melatonin
  - (C) somatotropin
  - (D) thyroxine
15. 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
16. During which stage of meiosis do homologous chromosomes pair up?
- (A) anaphase I
  - (B) anaphase II
  - ✓(C) prophase I
  - (D) prophase II
17. 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
18. 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.
19. 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

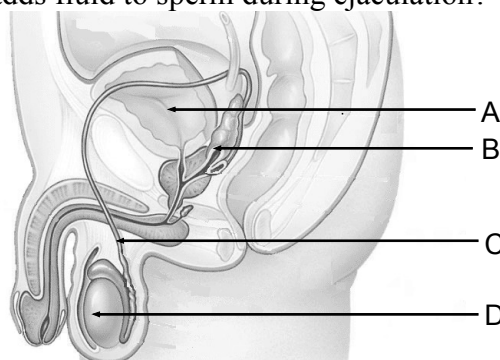
20. The diagram below shows the growth pattern of some human skin cells after they have been exposed to ultraviolet radiation. What type of cells are most likely found in area X?



- ✓(A) cancer  
 (B) red blood  
 (C) sex  
 (D) white blood
21. Double fertilization leads to the production of which two structures in flowering plants?
- (A) endosperm and pollen  
 ✓(B) endosperm and zygote  
 (C) ovule and seed  
 (D) ovule and zygote
22. Which structure is part of the female reproductive organ?



- (A) A  
 (B) B  
 (C) C  
 ✓(D) D
23. Which structure adds fluid to sperm during ejaculation?



- (A) A  
 ✓(B) B  
 (C) C  
 (D) D
24. Which structure is shed from the body during menstruation?
- ✓(A) endometrium  
 (B) fimbriae  
 (C) follicle  
 (D) placenta

25. What is true when progesterone levels are high during the menstrual cycle?
- (A) Estrogen production is inhibited.
  - (B) Estrogen production is stimulated.
  - ✓(C) Luteinizing hormone production is inhibited.
  - (D) Luteinizing hormone production is stimulated.
26. Which is the most common surgical method of reproductive control for human males?
- (A) abstinence
  - (B) condom use
  - (C) contraceptive implant
  - ✓(D) vasectomy
27. Which reproductive technology would a woman most likely use if she is unable to carry a child to term?
- (A) artificial insemination
  - (B) cryopreservation
  - (C) in vitro fertilization
  - ✓(D) surrogate mother
28. Which method of birth control is most effective at preventing sperm from entering the cervix?
- ✓(A) condom
  - (B) IUD
  - (C) rhythm method
  - (D) tubal ligation
29. Which process involves cell division without cell growth?
- ✓(A) cleavage
  - (B) fertilization
  - (C) implantation
  - (D) ovulation
30. Which results in a high risk pregnancy?
- (A) fertilization occurring in the ovary
  - (B) fertilization occurring in the oviduct
  - (C) implantation occurring in the ovary
  - ✓(D) implantation occurring in the oviduct
31. Which teratogen may result in constriction of fetal blood vessels?
- (A) alcohol
  - ✓(B) cigarette smoke
  - (C) thalidomide
  - (D) X-rays
32. Which hormone maintains the corpus luteum for the first three months of pregnancy and can also be detected in the urine of a pregnant woman?
- (A) follicle stimulating hormone
  - ✓(B) human chorionic gonadotropin
  - (C) human growth hormone
  - (D) thyroid stimulating hormone

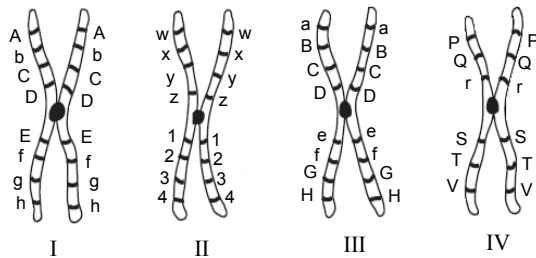
33. Which stage of childbirth involves the baby's head rotating, making it easier for the body to pass through the birth canal?
- (A) delivery
  - (B) dilation
  - ✓(C) expulsion
  - (D) placental
34. Which hormone increases in the mother's blood following the delivery of the baby?
- (A) follicle stimulating hormone
  - (B) human growth hormone
  - (C) progesterone
  - ✓(D) prolactin
35. How is a mother affected when an infant refuses to suckle the breast?
- (A) estrogen levels decrease
  - (B) estrogen levels increase
  - ✓(C) milk production decreases
  - (D) milk production increases
36. Which is the study of variation and inheritance in organisms?
- (A) evolution
  - ✓(B) genetics
  - (C) physiology
  - (D) zoology
37. What is the probability of parents having three girls in a row?
- (A)  $\frac{1}{9}$
  - ✓(B)  $\frac{1}{8}$
  - (C)  $\frac{1}{3}$
  - (D)  $\frac{1}{2}$
38. What does the Law of Independent Assortment state?
- (A) During gamete formation alleles separate.
  - (B) During gamete formation genes separate.
  - (C) The inheritance of alleles for one trait will affect the inheritance of alleles for another trait.
  - ✓(D) The inheritance of alleles for one trait will not affect the inheritance of alleles for another trait.
39. A white bull is crossed with a red cow. All the offspring produced are roan, containing both red and white hairs. Which describes this inheritance pattern?
- ✓(A) co-dominance
  - (B) incomplete dominance
  - (C) sex-linked inheritance
  - (D) polygenic inheritance

40. In the cross  $Rr \times rr$ , what percentage of offspring show the recessive trait?
- (A) 25%
  - ✓(B) 50%
  - (C) 75%
  - (D) 100%
41. A cross was made between two black, rough-haired guinea pigs. The resulting offspring included 6 with black rough hair and 1 with white smooth hair. Which describes this situation?
- (A) Both genes are co-dominant.
  - (B) Both genes are polygenic.
  - ✓(C) Both parents are heterozygous.
  - (D) Both white and smooth are dominant traits.
42. In cattle, hornless (H) is dominant over horned (h). A hornless bull is mated with 3 cows. Cow 1 (horned) produces a horned calf, cow 2 (hornless) produces a horned calf, and cow 3 (hornless) produces a hornless calf. Which of the cattle must have a heterozygous genotype for this trait?
- (A) bull and cow 1
  - ✓(B) bull and cow 2
  - (C) cow 2 and calf 2
  - (D) cow 3 and calf 3
43. Which describes a test cross?
- (A) heterozygous  $\times$  unknown
  - (B) homozygous  $\times$  unknown
  - ✓(C) recessive  $\times$  unknown
  - (D) unknown  $\times$  unknown
44. Who discovered sex-linkage?
- (A) Boveri
  - (B) Mendel
  - ✓(C) Morgan
  - (D) Sutton
45. A man who has type B blood and a woman who has type A blood have a child with blood type O. What are the genotypes of the parents?
- (A)  $I^B I^B$  and  $I^A I^A$
  - (B)  $I^B i$  and  $I^A I^A$
  - (C)  $I^B I^B$  and  $I^A i$
  - ✓(D)  $I^B i$  and  $I^A i$
46. How did Morgan's research with *Drosophila* change the understanding of Mendel's Law of Independent Assortment?
- ✓(A) Genes located on the same chromosome will be inherited together.
  - (B) Modifier genes work with other genes to control the expression of traits.
  - (C) Multiple genes result in continuous variation.
  - (D) Sex-linked genes are found on the Y chromosome.

47. Who developed the concept of “jumping genes”?

- (A) Avery
- (B) Crick
- (C) Griffiths
- ✓(D) McClintock

48. Which chromosomes below are homologous?



- ✓(A) I and III
- (B) I and IV
- (C) II and III
- (D) II and IV

49. What is the probability that a male will inherit a sex-linked recessive allele from his father?

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

50. Which components make up a DNA nucleotide?

- ✓(A) adenine - deoxyribose - phosphate group
- (B) guanine - deoxyribose - sulphate group
- (C) thymine - ribose - phosphate group
- (D) uracil - ribose - sulphate group

51. Which is a difference between DNA and RNA?

- (A) DNA contains ribose and RNA contains deoxyribose.
- (B) DNA contains uracil and RNA contains guanine.
- ✓(C) DNA is in the nucleus and RNA is in both the nucleus and cytoplasm.
- (D) DNA is single stranded and RNA is double stranded.

52. If a DNA strand contains 31% cytosine, what percentage of the nucleotides contain thymine?

- ✓(A) 19%
- (B) 31%
- (C) 38%
- (D) 62%

53. If a DNA segment has sequence ATA CCG GCA, what is the sequence of its anti-codon?

- ✓(A) AUA CCG GCA
- (B) TAT GGC CGT
- (C) UAU GGC CGT
- (D) UAU GGC CGU

54. What is a mutation that has no effect on the polypeptide produced?

- (A) frameshift
- (B) mis-sense
- (C) nonsense
- ✓(D) silent

*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	<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

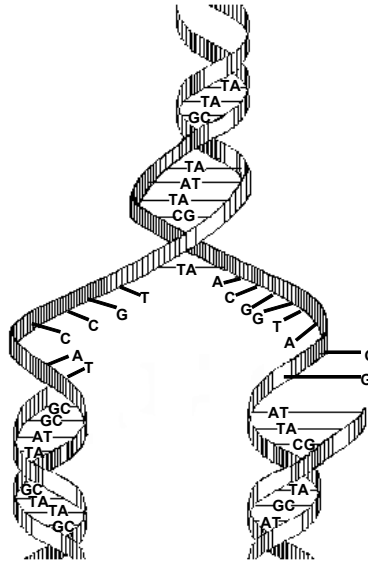
55. Using the RNA codon table above, which new amino acid is produced when the original RNA strand, GUG ACU UCG, becomes the mutated RNA strand, GUG AUU UCG?

- (A) alanine
- ✓(B) isoleucine
- (C) leucine
- (D) threonine

56. Which process results in Jacobs syndrome?

- (A) deletion
- (B) insertion
- ✓(C) nondisjunction
- (D) translocation

57. In which structure does the process shown below occur?



- (A) chloroplast
- (B) mitochondrion
- ✓(C) nucleus
- (D) ribosome

58. Which disease is characterized by rapid aging?

- (A) Huntington's
- (B) muscular dystrophy
- ✓(C) progeria
- (D) sickle cell anemia

59. A woman who is normal for blood clotting, has a father who is a hemophiliac. If she marries a man who is normal for blood clotting, what is the probability that they will have a child with hemophilia?

- (A) 0
- (B)  $\frac{1}{16}$
- ✓(C)  $\frac{1}{4}$
- (D)  $\frac{1}{2}$

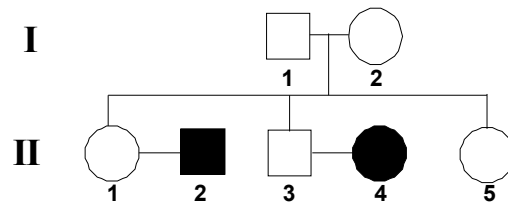
60. Which expression of chromosome content represents somatic cells in people with Down Syndrome?

- (A)  $n - 1$
- (B)  $n + 1$
- (C)  $2n - 1$
- ✓(D)  $2n + 1$

61. Which is a medical procedure where normal or modified genes are transferred into defective cells?

- (A) chorionic villi sampling
- (B) DNA amplification
- ✓(C) gene therapy
- (D) polymerase chain reaction

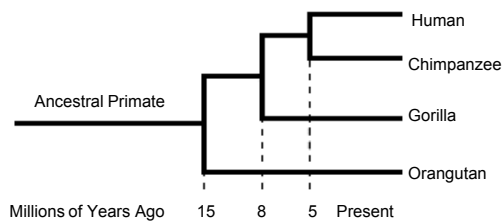
62. A genetic counsellor collected the pedigree information below in investigating the incidence of cystic fibrosis within a family. What are the genotypes of individuals I-1, I-2, and II-2?



	I-1	I-2	II-2
✓(A)	Aa	Aa	aa
(B)	AA	aa	Aa
(C)	$X^A y$	$X^A X^A$	$X y$
(D)	$X^A y$	$X^A x^A$	$X^A y$

63. Which is a technique that separates DNA fragments based on mass and electrical charge?
- (A) DNA amplification
  - (B) DNA cloning
  - ✓(C) gel electrophoresis
  - (D) polymerase chain reaction
64. How are restriction enzymes used in recombinant DNA technology?
- (A) carry foreign genes along with viral DNA into the host cell
  - (B) clone DNA fragments
  - ✓(C) cut large DNA molecules at sequence-specific sites
  - (D) join DNA fragments
65. Which factor involved in evolution by natural selection, is illustrated in the case of the peppered moth in England?
- (A) More young are born than can survive.
  - (B) Organisms do not vary in traits.
  - (C) Results from changes in individuals.
  - ✓(D) Some individuals are better adapted to the environment.
66. Which part of his Theory of Evolution was Darwin unable to explain?
- (A) competition
  - (B) overproduction
  - (C) reproduction
  - ✓(D) variation
67. Which describes how some species of algae and bacteria can survive and reproduce in hot springs, at temperatures near the boiling point of water?
- ✓(A) adaptation
  - (B) artificial selection
  - (C) convergent evolution
  - (D) reproductive isolation

68. Based on the diagram below, which organism is most closely related to humans?

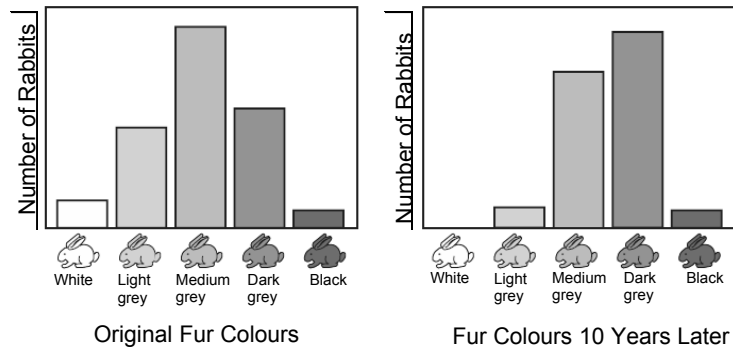


- (A) ancestral primate  
✓(B) chimpanzee  
(C) gorilla  
(D) orangutan
69. What must be obtained before scientists can place fossils in the ancestral time line of an animal?
- ✓(A) age of the fossil  
(B) complete skeleton  
(C) continent where the fossils were found  
(D) population trends for the species
70. In a population of squirrels that is in Hardy-Weinberg equilibrium, 91% are grey and 9% are black. If black colour is a recessive phenotype, what percentage of the population is homozygous dominant for this trait?
- (A) 21%  
(B) 42%  
✓(C) 49%  
(D) 70%
71. Which pre-zygotic isolating mechanism occurs when sexual reproduction between two individuals cannot take place because there are chemical differences between the sperm and egg?
- (A) behavioural isolation  
✓(B) gametic isolation  
(C) mechanism isolation  
(D) reproductive isolation
72. Which will most likely change the gene frequency in a population?
- (A) large population  
✓(B) mutations  
(C) random mating  
(D) stable environment
73. Which scientist demonstrated that a mixture of gases and water could be heated, cooled, and subjected to electrical discharges to generate simple organic molecules?
- (A) Hooker  
✓(B) Miller  
(C) Oparin  
(D) Watson

74. A group of large black mice become separated by the formation of a river. Over time the northern mice become smaller and whiter, while the southern mice remain the same. Which describes this situation?

- (A) convergence
- ✓(B) divergence
- (C) gametic isolation
- (D) transformation

75. The diagram below shows the change that occurred in the physical appearance of a rabbit population over a ten year period. Which best explains this change over time?



- ✓(A) a decrease in the advantage of having white fur
- (B) a decrease in the mutation rate of the rabbits with black fur
- (C) an increase in the advantage of having white fur
- (D) an increase in the chromosome number of the rabbits with black fur

**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) State two reasons why “designer drugs” are more dangerous than prescription drugs.

---

**Any of the following reasons can be used. (1 mark for each reason)**

---

**Designer drugs are prepared by untrained and unlicensed chemists, thus there is no quality control.**

---

**Abuse of designer drugs is even more dangerous.**

---

**Dosage monitoring is poor to none.**

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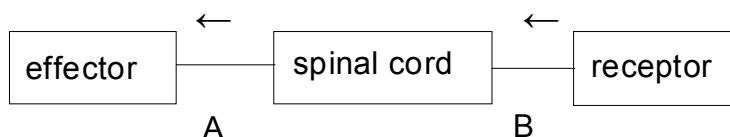
**These drugs may contain toxic impurities.**

---

**We are unaware of how addictive they may be.**

---

3% (b) The diagram below shows a nerve pathway in the human body that does not involve the brain.



i) Draw arrowheads on lines A and B in the diagram to show the direction of travel of the nerve pathway and name the response.

Response name: Reflex arc

ii) After a snowmobile accident a person cannot move his legs and loses the ability to feel pain in his legs. Give two possible reasons for the loss of these abilities.

---

**Possible answers:**

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**- Spinal cord injury**

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**- Brain damage**

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**- Nerve damage in the leg**

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**- Poor blood flow due to a blood clot that may form**

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**Value**

2% 77.(a) Two girls are twin sisters, yet one has brown eyes and the other has green eyes. State two ways this is biologically possible.

---

**They could be fraternal twins – occurs when more than one egg is released from the ovary or ovaries at the same time, and more than one egg is successfully fertilized, thus they will have different DNA.**

---

**One girl may not be producing enough eye pigment.**

---

**If they are identical twins, there could be a mutation (change in DNA) of one of the girls.**

---

3% (b) Cloning is a controversial procedure that holds promise for the treatment of a number of medical conditions.

i) Explain the role of therapeutic cloning in the treatment of diseases.

---

**Embryo is produced (cloned) in order to obtain stem cells which are used to treat conditions such as spinal cord injuries. Stem cells differentiate into cells that are of the same type as the damaged tissue. (1 mark)**

---

ii) Using two arguments to support your position, tell whether you agree or disagree with the use of therapeutic cloning.

---

**Yes-agree. Can use any two of the following reasons.**

---

**- helps cure diseases which can alleviate pain/illness**

---

**- furthers our understanding of development and differentiation**

---

**- can lead to other cures/discoveries etc.**

---

**- can save the life of a born child verses a potential child**

---

**No-disagree**

---

**- human embryos are involved, thus human life is destroyed**

---

**- possibility of rejection of foreign cells by the patient**

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**(2 marks total: 1 mark for each argument)**

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Value

- 2% 77. (c) A physician suspects that a developing fetus has Down syndrome. Describe two diagnostic techniques that would aid the physician in confirming this suspicion.

---

**Amniocentesis – cells in the amniotic fluid can be extracted and a fetal cell can be obtained. A karyotype chart is then done to see if trisomy 21 exists.**

---

**CVS – again fetal tissue can be obtained to do a karyotype chart. Looking for trisomy 21.**

---

**Fetoscopy – blood sample of the fetus can be obtained to construct a karyotype chart.**

---

**If trisomy 21 exists then the fetus has Down syndrome.**

---

- 3% 78.(a) The gene for red/green colour blindness is a recessive sex-linked trait. The gene for eye colour is not sex-linked. Brown eyes are dominant to blue eyes. A blue-eyed man with normal colour vision marries a woman homozygous for brown eyes and who is a carrier for colour blindness. Use a Punnett square to determine the genotypic ratios for their expected offspring.

**$bbX^cY \times BBX^CX^c$  (1 mark)**

**Punnett square (1 mark)**

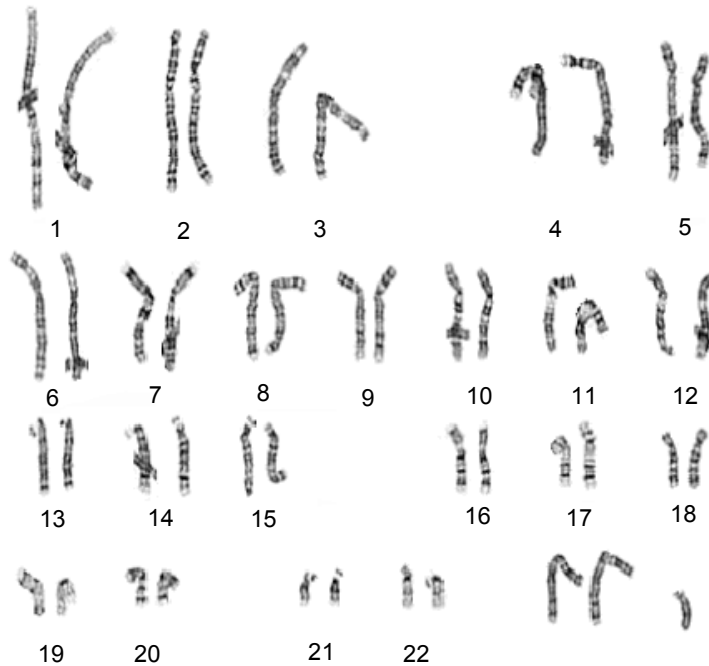
	<b><math>bX^C</math></b>	<b><math>bY</math></b>
<b><math>BX^C</math></b>	<b><math>BbX^CX^C</math></b>	<b><math>BbX^CY</math></b>
<b><math>BX^c</math></b>	<b><math>BbX^CX^c</math></b>	<b><math>BbX^cY</math></b>

**Genotypic ratio (1 mark)**

**$1 BbX^CX^C : 1 BbX^CY : 1 BbX^CX^c : 1 BbX^cY$**

Value

- 2% 78.(b) Two students observe the following karyotype but disagree as to which chromosomal disorder it represents. Student A suggests it represents a girl with Down syndrome and student B thinks it represents a boy with Klinefelter syndrome. Explain which student's diagnosis is correct.



---

**The condition is Klinefelter syndrome. (1 mark)**

---

**This is because the karyotype chart shows an XXY pattern. (1 mark)**

---

**Or you could say it is not Down syndrome because there is no trisomy 21.**

---

- 2% (c) More and more genetically modified foods (GMFs) are entering the marketplace. In Europe all GMFs must be clearly labelled, but this is not the case in Canada. Should the Canadian food industry be forced to follow GMF labelling guidelines? State two reasons to support your answer.

---

**Yes - we do need to know. Any two reasons listed below:**

---

**- it is the consumers right to know what they are eating**

---

**- medical health reasons are unknown**

---

**- could cause allergens**

---

**- an individual has the right to choose to eat something which may contain DNA from something else (example - tomato with fish DNA)**

---

**No - we don't need to know.**

---

**- nutritional value is what is most important**

---

**- even though the nutritional value may be higher, the GMF labels might turn people off**

---

**- cost**

---

**Value**

2% 78.(d) Person A has a mutation in a chromosome in a liver cell, while person B has a mutation in a chromosome in a sperm cell. Explain which mutation is most likely to be harmful to the offspring of each of these individuals.

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**Person B - Mutation in sex cells are passed on to the offspring while mutations in the body cells are not.**

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2% 79.(a) In the late Mesozoic Era a large meteorite impacted Earth causing a mass extinction of many life forms. Explain how this event allowed mammals to evolve and become a dominant animal life form.

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**Answer: Any two.**

- there was a reduction in competition so mammals became dominant**
  - the new environment was more suitable to mammals**
  - natural selection concept can be explained**
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2% (b) State one way that the Theory of Intelligent Design and the Theory of Panspermia are similar and one way in which they are different.

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**Similar:**

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**- both theories believe that life did not start spontaneously on Earth – outside forces or supreme beings started life**

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**Different:**

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**- intelligent design says that all life was created at the same time by a supreme being**

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**- panspermia assumes that life evolved according to the principles of chemical evolution**

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**- panspermia results from life from elsewhere**

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