

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

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

1. Which refers to the maintenance of a relatively constant internal environment?

- (A) equilibrium
- ✓ (B) homeostasis
- (C) negative feedback
- (D) positive feedback

2. Which work together to respond to emergency situations?

- (A) parasympathetic nervous system and adrenaline
- (B) parasympathetic nervous system and glutamate
- (C) sympathetic nervous system and adrenaline
- ✓ (D) sympathetic nervous system and glutamate

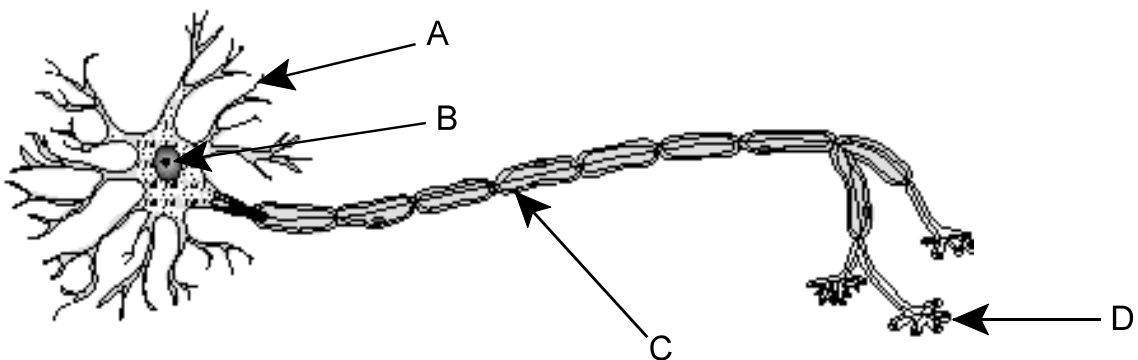
3. Which structure is part of the parasympathetic nervous system?

- (A) brain
- (B) meninges
- ✓ (C) sensory nerves
- (D) spinal cord

4. Which statement about neurons is true?

- (A) Potassium ions move inside the axon during depolarization.
- (B) Potassium ions move outside the axon during depolarization.
- ✓ (C) The inside of the cell is negatively charged at rest.
- (D) The outside of the cell is negatively charged at rest.

5. From which structure below does the cell body collect information?

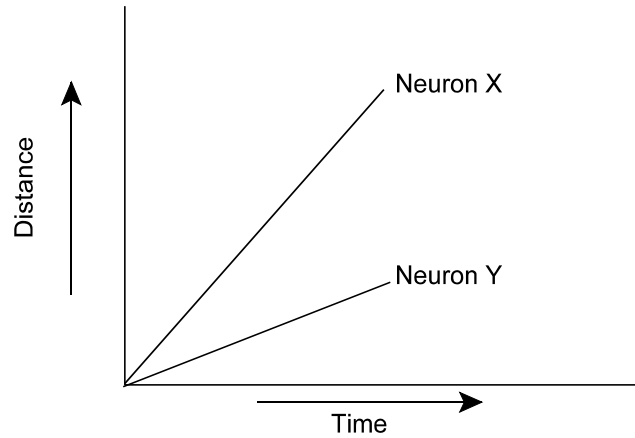


- ✓ (A) A
- (B) B
- (C) C
- (D) D

6. The ability to understand and answer questions is controlled by which structure of the brain?

- (A) cerebellum
- ✓ (B) cerebrum
- (C) hypothalamus
- (D) medulla oblongata

7. The graph below shows the distance a nerve impulse travelled over time for two different neurons (X and Y). What conclusion can best be drawn from the graph?



- (A) X is influenced by an anaesthetic and Y is influenced by caffeine.
- ✓ (B) X is myelinated and Y is unmyelinated.
- (C) Y is influenced by an anaesthetic and X is influenced by caffeine.
- (D) Y is myelinated and X is unmyelinated.
8. Which would best describe the effect of a drug used to treat chronic tremors and stiffness in limbs?
- (A) decreases autoimmune activity
- (B) decreases dopamine levels
- (C) increases autoimmune activity
- ✓ (D) increases dopamine levels
9. Which technology uses large magnets and computers to generate detailed images?
- (A) CAT scan
- (B) EEG
- ✓ (C) MRI
- (D) PET scan
10. Which condition is caused by the buildup of fluid between the lens and cornea?
- (A) astigmatism
- ✓ (B) glaucoma
- (C) hyperopia
- (D) myopia
11. What is the order of structures through which sound waves travel into the human ear?
- ✓ (A) auditory canal → eardrum → ossicles
- (B) auditory canal → ossicles → eardrum
- (C) eardrum → auditory canal → ossicles
- (D) eardrum → ossicles → auditory canal
12. In which structure of the human ear does an imbalance result in motion sickness?
- (A) auditory canal
- (B) eustachian tube
- ✓ (C) semicircular canal
- (D) tympanic membrane

13. Which gland releases melatonin?

- (A) adrenal
- ✓ (B) pineal
- (C) pituitary
- (D) thymus

14. How does insulin affect blood in a normal human body?

- (A) decreases calcium levels
- ✓ (B) decreases glucose levels
- (C) increases calcium levels
- (D) increases glucose levels

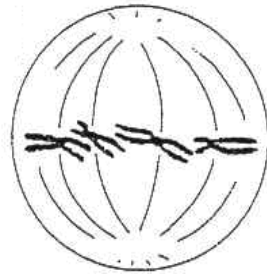
15. Which best describes the action of a drug that stimulates weight loss?

- (A) decreases the activity of the thymus gland
- (B) decreases the activity of the thyroid gland
- (C) increases the activity of the thymus gland
- ✓ (D) increases the activity of the thyroid gland

16. In which process does the cytoplasm of a eukaryotic cell divide to produce two cells?

- (A) anaphase
- ✓ (B) cytokinesis
- (C) mitosis
- (D) telophase

17. Which phase of mitosis is represented in the diagram below?



- (A) anaphase
- ✓ (B) metaphase
- (C) prophase
- (D) telophase

18. What is the advantage of crossing over during meiosis?

- (A) decreases mutations
- (B) decreases sterility
- (C) increases immunity
- ✓ (D) increases variation

19. Which characteristic is common for egg cells and sperm cells?

- (A) motility
- ✓ (B) number of chromosomes
- (C) number produced
- (D) size

20. If anaphase I did not occur in a human cell, how many chromosomes would be present in the four daughter cells produced by meiosis?

|       | daughter cell |    |    |    |
|-------|---------------|----|----|----|
|       | 1             | 2  | 3  | 4  |
| (A)   | 0             | 0  | 23 | 23 |
| ✓ (B) | 0             | 0  | 46 | 46 |
| (C)   | 22            | 22 | 24 | 24 |
| (D)   | 45            | 45 | 47 | 47 |

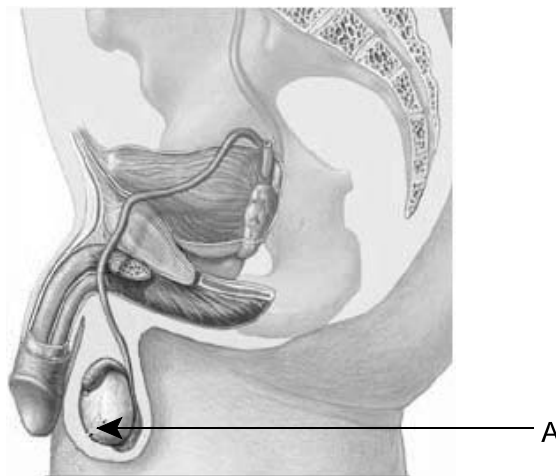
21. Which best describes both fertilizations that occur during sexual reproduction in flowering plants?

|       | 1 <sup>st</sup> fertilization | 2 <sup>nd</sup> fertilization |
|-------|-------------------------------|-------------------------------|
| ✓ (A) | $n + n \rightarrow 2n$        | $n + n + n \rightarrow 3n$    |
| (B)   | $n + n \rightarrow 2n$        | $2n + 2n \rightarrow 4n$      |
| (C)   | $n + n + n \rightarrow 3n$    | $n + n + n \rightarrow 3n$    |
| (D)   | $n + n + n \rightarrow 3n$    | $2n + 2n \rightarrow 4n$      |

22. Which structure produces semen secretions?

- (A) epididymis  
 ✓ (B) prostate  
 (C) urethra  
 (D) vas deferens

23. What is the function of the secretions produced by structure A in the diagram below?

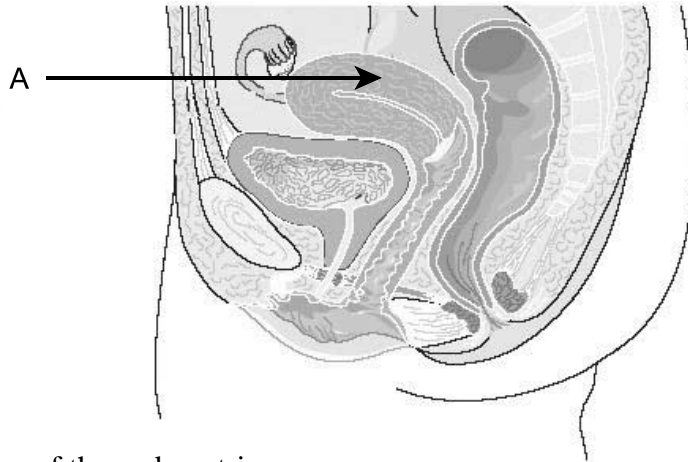


- (A) buffers the pH of the semen  
 ✓ (B) causes beard growth at puberty  
 (C) increases oxytocin level  
 (D) maintains constant temperature

24. What most likely happens when fallopian tubes become blocked?

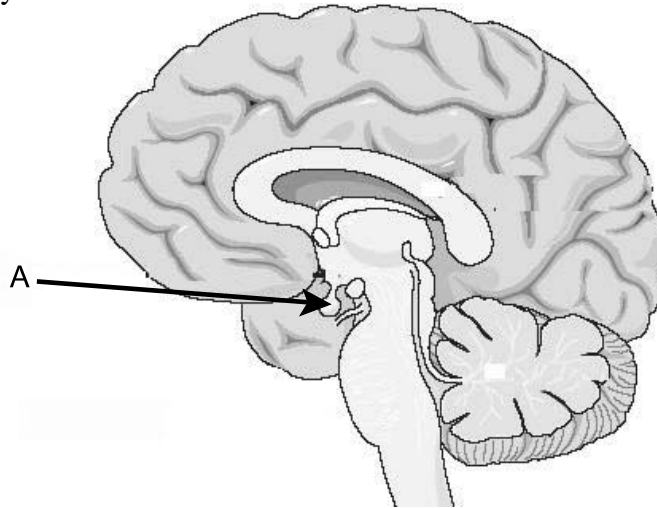
- (A) eggs are not produced  
 ✓ (B) fertilization is prevented  
 (C) ovulation stops  
 (D) sperm stop moving

25. What will most likely occur in structure A below if there is a reduction in progesterone secreted from the ovary?



- ✓ (A) breakdown of the endometrium
- (B) buildup of the endometrium
- (C) degeneration of a follicle
- (D) maturation of a follicle

26. What is the result of secretions produced by structure A below during days 15 to 28 of the uterine cycle?



- ✓ (A) endometrium disintegrates
- (B) endometrium thickens
- (C) follicle matures
- (D) follicle ruptures

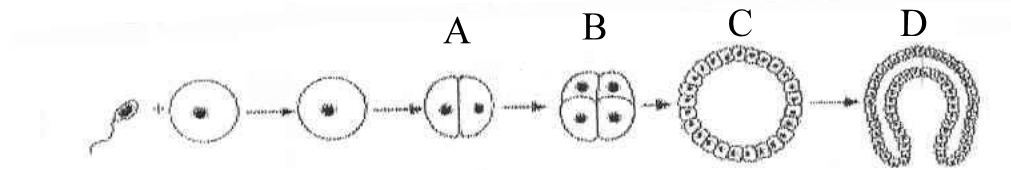
27. What would be the best solution for a couple experiencing infertility due to the male having a low sperm count?

- ✓ (A) artificial insemination
- (B) *in vitro* maturation
- (C) superovulation
- (D) tubal ligation

28. Which most likely describes the hormone levels of a pregnant human?

|       | Progesterone | FSH  | Estrogen |
|-------|--------------|------|----------|
| (A)   | low          | high | 0        |
| (B)   | low          | 0    | high     |
| (C)   | high         | high | 0        |
| ✓ (D) | high         | 0    | high     |

29. At which stage below does implantation occur?



- (A) A
- (B) B
- ✓ (C) C
- (D) D

30. Which sexually transmitted infection causes the appearance of blisters and is often accompanied by flu-like symptoms?

- (A) AIDS
- (B) chlamydia
- ✓ (C) genital herpes
- (D) gonorrhea

31. Which contraceptive method prevents the spread of sexually transmitted infections?

- ✓ (A) condom
- (B) diaphragm
- (C) Norplant
- (D) vasectomy

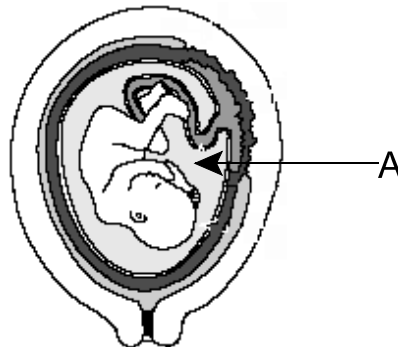
32. Which results in decreased sperm production?

- (A) converting protein from testes into muscle tissue
- ✓ (B) interfering with the control of FSH levels
- (C) stimulating the adrenal gland
- (D) suppressing thyroxine production

33. Which embryonic membrane forms blood vessels in the umbilical cord?

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

34. What is the function of structure A in the diagram below?



- ✓ (A) cushions the embryo
- (B) nutrient exchange
- (C) stimulates labour
- (D) stores waste

35. Which technique involves the extraction of fluid surrounding the embryo to check for chromosome abnormalities?

- ✓ (A) amniocentesis
- (B) CVS
- (C) fetoscopy
- (D) ultrasound

36. Which branch of biology deals with the principles of variation and inheritance?

- ✓ (A) embryology
- (B) genetics
- (C) neurology
- (D) zoology

37. What is the genetic make-up of an organism?

- ✓ (A) allele
- (B) genotype
- (C) hybrid
- (D) phenotype

38. What is the chance of a family having five boys in a row?

- (A)  $1/2$
- (B)  $1/16$
- ✓ (C)  $1/32$
- (D)  $1/64$

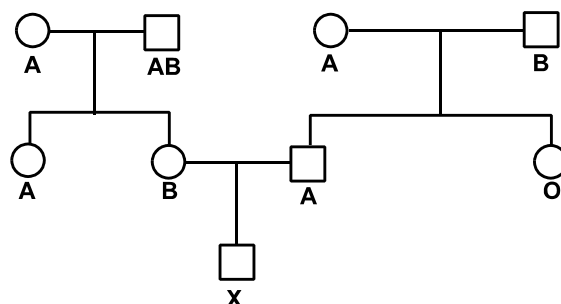
39. If tallness is a dominant trait of pea plants, which most likely describes two pea plants that produce 146 tall and 52 short plants when mated?

- ✓ (A) both heterozygous tall
- (B) both homozygous short
- (C) heterozygous tall and homozygous short
- (D) heterozygous tall and homozygous tall

40. Which is most likely the ratio resulting from a monohybrid cross with codominance if both parents are hybrid?

- ✓ (A) 1:1:1:1
- (B) 1:2:1
- (C) 2:2
- (D) 3:1

41. Using the diagram below, what is the chance that individual X will be blood type AB?



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

42. Horned trait in cattle is dominant (H) and hornless trait is recessive (h). If a horned bull is mated to the two cows described below, what are possible genotypes for the bull and cows?

Cow A - hornless; gives birth to a horned calf  
 Cow B - hornless; gives birth to a hornless calf

|       | <b>Bull</b> | <b>Cow A</b> | <b>Cow B</b> |
|-------|-------------|--------------|--------------|
| (A)   | HH          | Hh           | Hh           |
| (B)   | HH          | hh           | hh           |
| (C)   | Hh          | Hh           | Hh           |
| ✓ (D) | Hh          | hh           | hh           |

43. Which genetic syndrome is caused by an extra X chromosome in the male?

- (A) Down  
 (B) Jacob  
 ✓ (C) Klinefelter  
 (D) Turner

44. Which is a result of blending two traits from different alleles?

- (A) codominance  
 (B) crossing over  
 ✓ (C) incomplete dominance  
 (D) sex linkage

45. If a sex-linked trait affects more males than females, which conclusion should be drawn about the trait?

- (A) codominant  
 (B) incompletely dominant  
 (C) X-linked dominant  
 ✓ (D) X-linked recessive

46. Which scientist first developed the concept of “jumping genes”?

- (A) Griffith  
 (B) Levene  
 ✓ (C) McClintock  
 (D) Mendel

47. Who discovered the structure of the DNA molecule?

- (A) Franklin and Wilkins  
 (B) Hershey and Chase  
 (C) Sutton and Bovari  
 ✓ (D) Watson and Crick

48. Which nitrogen base is found in RNA only?

- (A) adenine  
 (B) cytosine  
 (C) guanine  
 ✓ (D) uracil



49. Which molecule carries amino acids to the ribosomes?

- (A) rDNA
- (B) rRNA
- (C) tDNA
- ✓ (D) tRNA

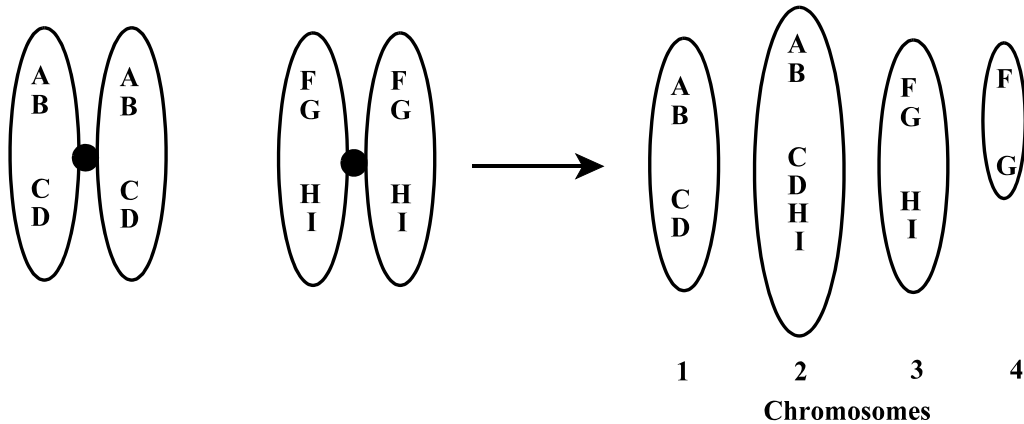
50. If the DNA code for an amino acid is CGA, what is the anticodon for the amino acid?

- ✓ (A) CGA
- (B) CGT
- (C) GCA
- (D) GCT

51. What would be the maximum number of amino acids contained in a protein made up of 30 nucleotides?

- ✓ (A) 10
- (B) 15
- (C) 30
- (D) 60

52. Which diagrams below show translocation?



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

53. Which affects an individual gene?

- (A) hybridization
- ✓ (B) mutation
- (C) nondisjunction
- (D) selective breeding

54. If a DNA molecule is found to contain 30% guanine, what percentage of adenine is present?

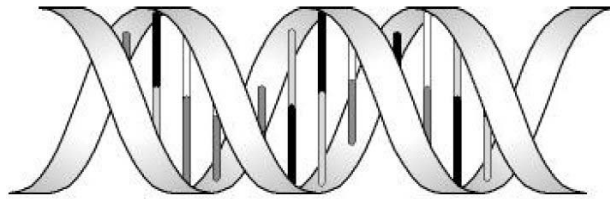
- ✓ (A) 20%
- (B) 30%
- (C) 60%
- (D) 80%

55. Eye color is a sex-linked trait in fruit flies. If red eyes are dominant and white eyes are recessive, which cross could produce red eyed males and white eyed females?
- ✓ (A) heterozygous red eyed females × white-eyed males  
 (B) heterozygous white eyed females × red-eyed males  
 (C) homozygous red eyed females × red-eyed males  
 (D) homozygous white eyed females × white-eyed males
56. Why is the human population on the island of Newfoundland suitable for studying human genetics?
- ✓ (A) More hybrid traits are present in the population.  
 (B) The founder effect is preserved.  
 (C) The population represents a small sample size.  
 (D) There is great genetic diversity.
57. Which organisms did Mendel use in studying genetics?
- (A) fruit flies  
 (B) humans  
 (C) monkeys  
 ✓ (D) pea plants
58. Which most likely represents the parents of a hemophiliac daughter?
- |       | <b>mother's genotype</b> | <b>father's phenotype</b> |
|-------|--------------------------|---------------------------|
| ✓ (A) | heterozygous             | hemophiliac               |
| (B)   | heterozygous             | normal                    |
| (C)   | homozygous dominant      | hemophiliac               |
| (D)   | homozygous dominant      | normal                    |
59. What is the phenotypic ratio of the offspring produced from a dihybrid cross between two heterozygous individuals?
- (A) 1:1:1:1  
 (B) 1:2:2:1  
 (C) 9:2:3:2  
 ✓ (D) 9:3:3:1
60. Which medical procedure treats genetic disorders by transferring normal or modified alleles into a person's defective cells?
- (A) amniocentesis  
 (B) electrophoresis  
 (C) fetoscopy  
 ✓ (D) gene therapy
61. Which process separates DNA fragments?
- (A) amplification  
 ✓ (B) gel electrophoresis  
 (C) karyotyping  
 (D) sequencing

62. What is a major finding of the Human Genome Project?

- (A) 83.5% of gorilla and human DNA are identical.
- ✓ (B) 99.9% of all human DNA are identical.
- (C) There are about 100 000 proteins.
- (D) There are 48 human chromosomes.

63. In which part of an eukaryotic cell is the structure below located?



- (A) cytoplasm
- (B) endoplasmic reticulum
- ✓ (C) golgi apparatus
- (D) nucleus

64. Whose evolutionary theories are most similar?

- ✓ (A) Darwin and Wallace
- (B) Lyell and Wallace
- (C) Malthus and Cuvier
- (D) McClintock and Cuvier

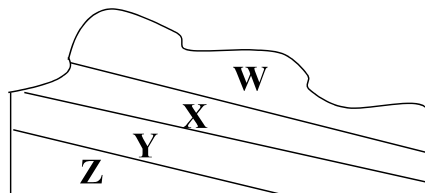
65. Which branch of comparative science describes the relationship between homologous structures?

- ✓ (A) anatomy
- (B) biochemistry
- (C) cytology
- (D) embryology

66. Which best describes the relationship between two species that share common ancestry?

- (A) few biochemical similarities
- (B) identical chromosome mutations
- (C) no structural differences
- ✓ (D) similar embryological development

67. Which is true for the fossils found in the sedimentary layers in the diagram below?



- (A) Fossils in W are less complex than in Y.
- (B) Fossils in W are older than in Y.
- ✓ (C) Fossils in X are more complex than in Z.
- (D) Fossils in X are older than in Z.

68. Which situation will allow gene frequencies to change?

- (A) isolation
- (B) large population
- ✓ (C) mutations
- (D) random mating

69. If the allele frequency of the dominant allele D in a Hardy-Weinberg population is 0.8, what are the expected genotype frequencies?

|       | <b>DD</b> | <b>Dd</b> | <b>dd</b> |
|-------|-----------|-----------|-----------|
| (A)   | 0.04      | 0.16      | 0.64      |
| (B)   | 0.04      | 0.32      | 0.64      |
| (C)   | 0.64      | 0.16      | 0.04      |
| ✓ (D) | 0.64      | 0.32      | 0.04      |

70. Which type of selection is occurring when a reptile population lays either very large eggs or very small eggs?

- ✓ (A) directional  
(B) disruptive  
(C) sexual  
(D) stabilizing

71. Which best explains the result of gene flow?

- ✓ (A) It decreases the genetic variation between different populations.  
(B) It decreases the genetic variation between different species.  
(C) It increases the genetic variation between different populations.  
(D) It increases the genetic variation between different species.

72. Which factor would lead to the bottleneck effect in a population?

- (A) high levels of gene flow  
(B) high mutation rates  
(C) random mating  
✓ (D) small population size

73. One species of wheat produces flowers from July to August. Another species of wheat produces flowers from March to June. Which type of isolation is this?

- (A) behavioural  
(B) habitat  
(C) mechanical  
✓ (D) temporal

74. If DNA replication occurred without errors, how would this affect a large population of organisms living on an isolated island?

- (A) Directional selection would occur due to genetic drift.  
(B) Disruption selection would occur due to genetic drift.  
✓ (C) Evolution would continue due to gene flow.  
(D) Evolution would continue due to mutations.

75. Two types of flying rodents live in different parts of the world. A flying squirrel lives in North America and a flying marsupial lives in Australia. Which type of evolution lead to this?

- (A) coevolution  
✓ (B) convergent  
(C) divergent  
(D) macroevolution

**PART II**  
**Total Value: 25%**

**Instructions: Complete all questions in this section. Your responses must be clearly presented in a well-organized manner.**

**Value**

2% 76.(a) A child shows abnormal growth of bone tissue causing extra long legs and arms. What is the probable cause of this condition and give two ways it can be treated?

**Excess production of human growth hormone is the cause. (1 mark)**

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**½ mark each for any two treatments below:**

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**(1) surgery to remove tumor**

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**(2) irradiation of gland tissue**

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**(3) hormone blocking drug**

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3% (b) In what three ways does the response of a nerve differ from the response of a hormone?

**1 mark for any three differences below:**

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**(1) a nerve response is fast while a hormone response is slow**

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**(2) a nerve response has a short duration while a hormone response has a long duration**

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**(3) a nerve response is electrical while a hormone response is chemical**

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**(4) a nerve response has a direct pathway while a hormone response has a general circulation**

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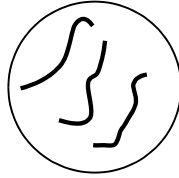
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**Value**

3% 77.(a) The diagram below represents a cell in telophase II.



- (1 mark) (i) How many chromosomes were present in this cell's parent cell? 6
- (ii) If the cell above was a result of nondisjunction, how many chromosomes were present in the parent cell? Explain.

**1 mark for the number of chromosomes and 1 mark for the explanation**

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**Two different answers acceptable, depending on how the parent cell is interpreted:**

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**2 or 4 chromosomes if the parent cell is a secondary sex cell**

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**OR**

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**4 or 8 chromosomes if the parent cell is a primary sex cell**

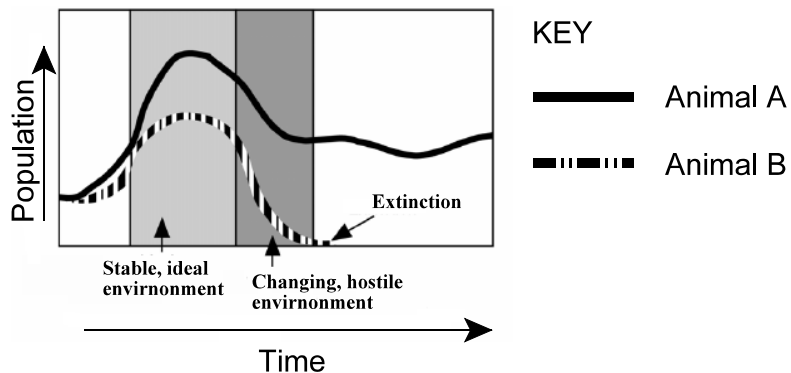
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3% (b) The graph below shows the growth of two animals (A and B) over time.



- (i) Which animal (A or B) reproduces asexually, and which one produces sexually?
- (2 marks) Asexually: B Sexually: A
- (1 mark) (ii) Justify your answer from (i)?

**Sexual reproduction results in a greater variation of individuals within a**

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**This would enable the animal population to have a better survival rate during a**

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**changing, hostile environment than a population that reproduces asexually,**

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**in less variation.**

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**Value**

2% 78.(a) In pea plants, green colour is dominant to yellow. Describe a cross that could be used to determine if a green pea plant is homozygous dominant.

**(1 mark) Cross the green plant with a yellow plant (homozygous recessive).**

**(½ mark) If all offspring are green, the green plant is most likely homozygous.**

**(½ mark) If some offspring are yellow, the green plant is definitely heterozygous.**

**Note: If students mentioned a test cross was used but the explanation was incorrect, they received 1 mark only.**

2% (b) DNA amplification is used on a crime scene to get evidence on a suspect. Explain which amplification method would be best for gathering DNA evidence?

**(1 mark) Polymerase Chain Reaction**

**(1 mark) PCR is fast and requires less DNA than the other methods.**

3% (c) In pea plants, spherical seed shape (S) is dominant to dented seed shape (s) and yellow seeds (Y) are dominant to green seeds (y). If two pea plants, each heterozygous for both traits, are crossed, what is the probability of the offspring having dented, yellow seeds? Show workings.

**Parents: SsYy × SsYy (½ mark)**

|           |             |             |             |             |
|-----------|-------------|-------------|-------------|-------------|
|           | <b>SY</b>   | <b>Sy</b>   | <b>sY</b>   | <b>sy</b>   |
| <b>SY</b> | <b>SSYY</b> | <b>SSYy</b> | <b>SsYY</b> | <b>SsYy</b> |
| <b>Sy</b> | <b>SSYy</b> | <b>SSyy</b> | <b>SsYy</b> | <b>Ssyy</b> |
| <b>sY</b> | <b>SsYY</b> | <b>SsYy</b> | <b>ssYY</b> | <b>ssYy</b> |
| <b>sy</b> | <b>SsYy</b> | <b>Ssyy</b> | <b>ssYy</b> | <b>ssyy</b> |

**(½ mark for gametes)**

**(1 mark for Punnett Square)**

**(½ mark for identifying genotypes)**

**(½ mark) From the Punnett Square, the probability of the offspring having dented, yellow seeds is 3/16 or 0.1875.**

**Note: 18.75% was also accepted as an answer.**

**Value**

3% 78.(d) A mutation changed the fourth codon (ACG) of the DNA sequence below to ACT.  
GAC GGA CCA ACG GCA

(1 mark) (i) What type of gene mutation caused this change? Point Mutation OR Base Substitution

(1 mark) (ii) What tRNA molecule is produced from the mutated DNA strand?  
GAC GGA CCA ACU GCA

(1 mark) (iii) What is the difference between the polypeptide sequence produced from the original DNA strand and the polypeptide sequence produced from the mutated DNA strand?

**A different amino acid is produced which would result in a different protein produced.**

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2% 79.(a) If the half life of carbon-14 is 5730 years, what percentage of carbon-14 remains in a fossil that is approximately 17 190 years old.? Show all workings.

$$\frac{17190 \text{ years}}{5730 \text{ years}} = 3 \text{ half lifes (1 mark)}$$

$$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8} = 0.125$$

$$0.125 \times 100\% = 12.5\% \text{ (1 mark)}$$

2% (b) Living organisms have been discovered on Earth in hot ocean vents. Why has this discovery led to an increased search for extraterrestrial life on other planets?

**If organisms can exist in environments that have extremely harsh conditions, like hot ocean vents, then maybe they can exist on other planets that also have extremely harsh conditions. (2 marks)**

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