



FACULTY OF SCIENCE

DEPARTMENT OF BOTANY AND PLANT BIOTECHNOLOGY

LSFT0A3

LIFE SCIENCE 3A FET

APK CAMPUS

JULY SUPPLEMENTARY EXAM

DATE: JULY 2019
SESSION:
ASSESSOR: MS J. WILLIAMSON
INTERNAL MODERATOR: DR. H. BYTH-ILLING
EXTERNAL MODERATOR: PROF. G. LAUTENBACH
DURATION: 3 HOURS
TOTAL MARKS: 150

NUMBER OF PAGES: 11 PAGES

Please read the following instructions carefully

1. Answer all the questions in the question paper
2. Answer ALL of the questions in the test book.
3. Work neatly.
4. Read your questions carefully.
5. Good Luck

QUESTION 1**[18]**

Choose the best answer to complete the statement or answers the question. Only write down the correct letter next to the appropriate question number.

- 1.1 John, age 47, has just been diagnosed with Huntington's disease, which is caused by a dominant allele. His daughter, age 25, now has a 2-year-old son. No one else in the family has the disease. What is the probability that the daughter will have the disease?
- A. 0%
 - B. 25%
 - C. 50%
 - D. 75%
 - E. 100%
- 1.2 The following offspring were observed from many crossings of the same pea plants. What genotypes were the parents?
- | | |
|--------------------------|-----------------------------|
| 465 purple axial flowers | 152 purple terminal flowers |
| 140 white axial flowers | 53 white terminal flowers |
- A. PpAa x PpAA
 - B. PpAa x ppAA
 - C. PPAA x ppaa
 - D. PpAa x PpAa
 - E. PPaa x ppAA
- 1.3 Mendel's second law of independent assortment has its basis in which of the following events of meiosis I?
- A. Synapsis of homologous chromosomes.
 - B. Crossing over.
 - C. Alignment of tetrads at the equator.
 - D. Separation of homologous chromosomes at anaphase.

- E. Separation of cells at telophase.
- 1.4 An advantage of internal fertilization over external fertilization is that _____
- A. internal fertilization allows animals to reproduce sexually.
 - B. internal fertilization requires much less expenditure of resources.
 - C. internal fertilization produces more offspring, ensuring rapid population growth.
 - D. internal fertilization prevents the drying out of gametes in a dry environment.
- 1.5 Environmental cues that influence the timing of reproduction generally do so by _____
- A. increasing the body temperature.
 - B. providing access to water for external fertilization.
 - C. increasing ambient temperature to that which is comfortable for sex.
 - D. direct effects on gonadal structures.
 - E. direct effects on hormonal control mechanisms.
- 1.6 The cortical reaction functions directly in the _____
- A. formation of a fertilization envelope.
 - B. production of a fast block to polyspermy.
 - C. release of hydrolytic enzymes from the sperm cell.
 - D. generation of a nerve-like impulse by the egg cell.
 - E. fusion of egg and sperm nuclei.
- 1.7 In vertebrate animals, spermatogenesis and oogenesis differ, in that _____
- A. oogenesis begins at the onset of sexual maturity, whereas spermatogenesis happens in embryonic development.
 - B. oogenesis produces four (4) haploid cells, whereas spermatogenesis produces only one (1) functional spermatozoon.

- C. cytokinesis is unequal in oogenesis, whereas it is equal in spermatogenesis.
- D. oogenesis ends at menopause, whereas spermatogenesis is finished before birth.
- E. spermatogenesis is not completed until after fertilization occurs, but oogenesis is completed by the time a girl is born.
- 1.8 Among these contraception methods, which has the highest risk of accidental pregnancy?
- A. Diaphragm
- B. Condom
- C. Coitus interruptus
- D. Vasectomy
- E. Rhythm method
- 1.9 Human fertility drugs increase the chance of multiple births, probably because they ____
- A. enhance implantation.
- B. stimulate follicle development.
- C. mimic progesterone.
- D. stimulate spermatogenesis.
- E. prevent parturition.
- 1.10 The spontaneous loss of amino groups from adenine results in hypoxanthine, an uncommon base, opposite thymine in DNA. What combination of molecules could repair such damage?
- A. Nuclease, DNA polymerase, DNA ligase
- B. Telomerase, primase, DNA polymerase
- C. Telomerase, helicase, single-strand binding protein
- D. DNA ligase, replication fork proteins, adenylyl cyclase

- E. Nuclease, telomerase, primase
- 1.11 In an analysis of the nucleotide composition of DNA, which of the following will be found?
- A. $A = C$
 - B. $A = G$ and $C = T$
 - C. $A + C = G + T$
 - D. $G + C = T + A$
- 1.12 When T2 phages infect bacteria and make more viruses in the presence of radioactive sulphur, what is the result?
- A. The viral DNA will be radioactive.
 - B. The viral proteins will be radioactive.
 - C. The bacterial DNA will be radioactive.
 - D. Both A and B
 - E. Both A and C
- 1.13 Which of the following DNA mutations is the most likely to be damaging to the protein it specifies?
- A. A base-pair deletion.
 - B. A codon substitution.
 - C. A substitution in the last base of a codon.
 - D. A codon deletion.
 - E. A point mutation.
- 1.14 In an experimental situation, a student researcher inserts an mRNA molecule into a eukaryotic cell after he has removed its 5' cap and poly(A) tail. Which of the following would you expect him to find?

- A. The mRNA could not exit the nucleus to be translated.
 - B. The cell recognizes the absence of the tail and polyadenylates the mRNA.
 - C. The molecule is digested by restriction enzymes in the nucleus.
 - D. The molecule is digested by exonucleases since it is no longer protected at the 5' end.
 - E. The molecule attaches to a ribosome and is translated, but more slowly.
- 1.15 Which component is not directly involved in translation?
- A. mRNA
 - B. DNA
 - C. tRNA
 - D. Ribosomes
 - E. GTP
- 1.16 For a species with a haploid number of 23 chromosomes, how many different combinations of maternal and paternal chromosomes are possible for the gametes?
- A. 23
 - B. 46
 - C. 460
 - D. 920
 - E. About 8 million
- 1.17 Independent assortment of chromosomes is a result of _____
- A. the random and independent way in which each pair of homologous chromosomes lines up at the metaphase plate during meiosis I.
 - B. the random nature of the fertilization of ova by sperm.

- C. the random distribution of the sister chromatids to the two (2) daughter cells during anaphase II.
- D. the relatively small degree of homology shared by the X and Y chromosomes.
- E. All of the above
- 1.18 How do cells at the completion of meiosis compare with cells that have replicated their DNA and are just about to begin meiosis?
- A. They have twice the amount of cytoplasm and half ($\frac{1}{2}$) the amount of DNA.
- B. They have half ($\frac{1}{2}$) the number of chromosomes and half ($\frac{1}{2}$) the amount of DNA.
- C. They have the same number of chromosomes and half ($\frac{1}{2}$) the amount of DNA.
- D. They have half ($\frac{1}{2}$) the number of chromosomes and one-fourth ($\frac{1}{4}$) the amount of DNA.
- E. They have half ($\frac{1}{2}$) the amount of cytoplasm and twice the amount of DNA.

QUESTION 2

[18]

Give the correct biological term for each of the following definitions. Only write down the correct term next to the appropriate question number.

- 2.1 Human skin colour is an example of this genetic phenomenon.
- 2.2 When two (2) alleles of one (1) gene differ.
- 2.3 The father of genetics.
- 2.4 The type of organism which develop in a fluid-filled sac in a shell or the uterus.
- 2.5 The embryonic layer which develops into the thymus of the organism.
- 2.6 Reproduction in which eggs are laid and embryos develop outside the mother's body.
- 2.7 From the seminiferous tubules of a testis, sperm pass into these coiled tubules.
- 2.8 The skin covering the head of the penis.

- 2.9 The condition of carrying one (1) or more embryo in the uterus.
- 2.10 The functional group attached to the 3' Carbon of a nucleotide.
- 2.11 Double ring structure found in a DNA double helix.
- 2.12 The scientist who discovered that genes are located on chromosomes.
- 2.13 The base-triplet found at the bottom end of the structure which picks up amino acids during transcription.
- 2.14 One (1) other pyrimidine other than uracil.
- 2.15 The DNA strand not used to synthesise mRNA.
- 2.16 The attachment of a segment to a non-homologous chromosome that can be reciprocal.
- 2.17 Disorder caused by non-disjunction taking place during meiosis in the egg or sperm cell resulting in two (2) X and one (1) Y chromosome.
- 2.18 An ordered display of magnified images of an individual's chromosomes arranged in pairs.

QUESTION 3

[19]

- 3.1 Suppose in a strain of soybeans, high oil (H) content in the seeds is dominant to low oil content and four (4) seeds (E) in a pod is dominant to two (2) seeds in a pod. A farmer crosses two (2) soybean plants, both with high oil content and four (4) seeds per pod. The resulting F1 offspring have a phenotypic ratio of 9:3:3:1 (High oil / four(4) seeds : High oil / two(2) seeds : Low oil / four(4) seeds : Low oil / two(2) seeds). What genotype were the parent plants? (Show the cross to proof your answer). (17)
 - 3.2 Briefly name and describe the two (2) laws Mendel formulated after completing a few crosses using pea plants. (4 x ½ = 2)
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QUESTION 4

[19]

4.1 Name and briefly describe the three (3) steps of how a zygote becomes an animal?

(6 x ½ = 3)

4.2 Name and briefly discuss the three (3) methods of reproduction in which eggs are laid and embryos develop. (13)

4.3 What is holoblastic cleavage? Give an example of an animal that portrays this type of cleavage? (3)

QUESTION 5

[19]

5.1 Name and discuss three (3) ways to detect disorders during pregnancy. (6)

5.2 Explain the ovarian and uterine cycle of the human female. (8)

5.3 Name three (3) types of sex hormones produced and released by gonads. (3)

5.4 Discuss the role of testosterone in the male reproduction system. (4 x ½ = 2)

QUESTION 6

[19]

6.1 Discuss the process of DNA replication. (19)

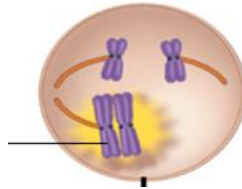
QUESTION 7

[19]

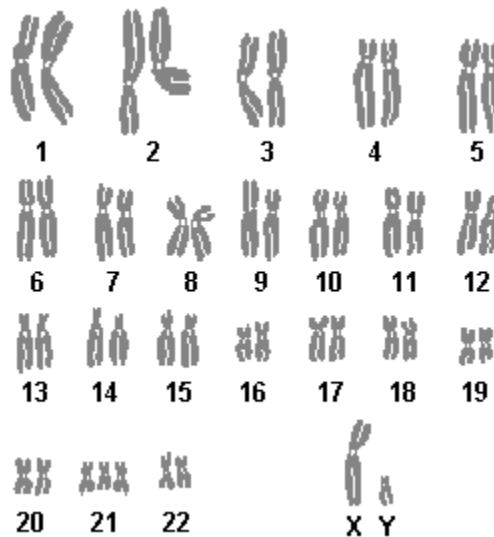
7.1 Name and discuss the process of protein synthesis which occurs in the cytoplasm of the cell. (19)

QUESTION 5
[19]

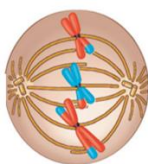
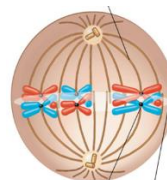
- 8.1 Accidents during meiosis can alter chromosome number. Identify the “accident” in the diagram below. (2)



- 8.2 Study the diagram below and answer the questions that follow.



- 8.2.1 What does this diagram represent? (1)
- 8.2.2 What is the sex of this person? Give a visible reason for your answer. (2)
- 8.2.3 What disorder does this person suffer from (give two (2) possible names for this disorder)? (2)
- 8.2.4 Discuss what causes this disorder in question 8.2.3. (2)
- 8.3 Study the diagrams below and answer the questions that follow.

Diagram A

Diagram B


- 8.3.1 Name the phase of meiosis in diagram A and diagram B respectively. (2)
- 8.3.2 What is the main difference between the phase in diagram A and the phase in diagram B? (2)
- 8.4 How do Mitosis differ from Meiosis with regard to the second and fourth phases? Tabulate your answer. (6)
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