FACULTY OF SCIENCE

DEPARTMENT BOTANY AND PLANT BIOTECHNOLOGY

LS3AFET / LSFT0A3

LIFE SCIENCE 3A FET

APK CAMPUS

JUNE EXAM (UNITS: 1-6)

9 JUNE 2016

DATE:	**9 JUNE 2016**
SESSION:	**8H30-11H30**
ASSESSOR:	**MS J. WILLIAMSON**
INTERNAL MODERATOR:	**DR. A. NEL**
EXTERNAL MODERATOR:	**PROF. J. DE BEER**
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 alternative that best completes the statement or answers the question. Only write down the correct letter next to the appropriate question number.

1.1 How do the leading and the lagging strands differ?

A. The leading strand is synthesized in the same direction as the movement of the replication fork, whereas the lagging strand is synthesized in the opposite direction.
B. The leading strand is synthesized at twice the rate of the lagging strand.
C. The lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.
D. The leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, whereas the lagging strand is synthesized by adding nucleotides to the 5' end.

1.2 Nitrogenous bases are paired in specific combinations. Which of the following does not provide evidence to support this conclusion?

A. A purine-purine pair is too wide to account for the 2-nm diameter of the double helix.
B. A pyrimidine-pyrimidine pair is too narrow to account for the 2-nm diameter of the double helix.
C. The X-ray data suggested that the double helix had a uniform diameter.
D. Whenever one strand of DNA has an A, the partner strand has a T.
E. The pairs of nitrogenous bases are held together by hydrogen bonds.

1.3 Which of the following is an example of “recombinant DNA”?

A. Combining alternate alleles of a gene in a single cell
B. Manipulating a meiotic crossing-over event
C. Cloning genes from homologous pairs of chromosomes
D. Introducing a human gene into a bacterial plasmid
E. Alternate alleles assorting independently

1.4 Which of the following can be the final product of an expressed gene?

A. mRNA
B. tRNA
C. rRNA
D. polypeptide

1.5 The nitrogenous base adenine is found in all members of which group?

A. Proteins, triglycerides, and testosterone

B. Proteins, ATP, and DNA

C. ATP, RNA, and DNA

D. Alpha glucose, ATP, and DNA

E. Proteins, carbohydrates, and ATP

1.6 There are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. This is best explained by the fact that _____

A. some tRNAs have anticodons that recognize four or more different codons.

B. the rules for base pairing between the third base of a codon and tRNA are flexible.

C. many codons are never used, so the tRNAs that recognize them are dispensable.

D. the DNA codes for all 61 tRNAs but some are then destroyed.

E. competitive exclusion forces some tRNAs to be destroyed by nucleases.

1.7 Which of the following transmits genes from both parents to child, or from one generation of a family to another?

A. DNA
B. Gametes
C. Somatic cells

D. Mitosis

E. Nucleotides

1.8 Why is it more practical to prepare karyotypes by viewing somatic diploid cells rather than haploid gametes?

A. Somatic diploid cells do not contain organelles to interfere with karyotyping.
B. Both sets of chromosomes, which are present in somatic diploid cells, need to be examined.
C. DNA in haploid gametes will not stain.

D. The chromosomes are larger in a somatic diploid cell.

E. Haploid gametes do not have sex chromosomes.

1.9 Gametes produced from one meiotic event _____

A. are genetically identical to each other.

B. each have the same chromosome number.

C. are genetically identical to the cells produced from meiosis I.

D. are genetically identical to the parent cell.

E. each have the same mutations.

1.10 Pea plants were particularly well suited for use in Mendel's breeding experiments for all of the following reasons except that _____

A. peas show easily observed variations in a number of characters, such as pea shape and flower color.

B. it is possible to control mating between different pea plants.

C. it is possible to obtain large numbers of progeny from any given cross.

D. peas have an unusually long generation time.

E. many of the observable characters that vary in pea plants are controlled by single genes.

1.11 A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates _____

A. the blending model of genetics.

B. true breeding.

C. dominance.

D. a dihybrid cross.

E. the mistakes made by Mendel.

1.12 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 contract the disease?

A. 0%

B. 25%

C. 50%

D. 75%

E. 100%

1.13 If you observe vertebrate organisms with parthenogenetic reproduction, internal development of embryos, and the lack of parental care for its young, you should categorize these organisms as _____

A. earthworms.

B. lizards.

C. birds.

D. frogs.

E. mammals.

1.14 A cloaca is an anatomical structure found in many non-mammalian vertebrates, which functions as _____

A. a specialized sperm-transfer device produced by males.

B. a common exit for the digestive, excretory, and reproductive systems.

C. a region bordered by the labia minora and clitoris in females.

D. a source of nutrients for developing sperm in the testes.

E. a gland that secretes mucus to lubricate the vaginal opening.

1.15 Internal and external fertilization both _____

A. produce zygotes.

B. occur only among invertebrates.

C. occur only among terrestrial animals.

D. depend on the use of intromittent copulatory organs.

E. occur only among birds.

1.16 The formation of the fertilization membrane and the slow block to polyspermy are dependent on _____

A. the entrance of potassium ions into the egg.

B. the departure of sodium ions from the egg.

C. the entrance of calcium ions into the egg.

D. the departure of hydrogen ions from the egg.

1.17 In humans, oogenesis is completed _____

A. after ovulation, but before the sperm enters the oocyte.

B. after the nuclei of the sperm and egg fuse.

C. once the sperm penetrates the oocyte.

D. prior to ovulation.

E. during embryonic development.

1.18 This hormone is secreted directly from a structure in the brain:

A. testosterone

B. estradiol

C. progesterone

D. follicle stimulating hormone

E. gonadotropin-releasing hormone

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 The enzyme which allows the addition of free nucleotides during a PCR reaction.

2.2 The product which forms if a human gene is inserted into the plasmid of a bacterium.

2.3 The enzyme joining Okazaki fragments.

2.4 The starting point of the DNA code.

2.5 The enzyme responsible for adding RNA nucleotides to form an mRNA strand.

2.6 The non-coding parts of an mRNA strand.

2.7 The attachment of a segment to a non-homologous chromosome that can be reciprocal.

2.8 A disease caused by X0 chromosomes.

2.9 Synonym for a body cell.

2.10 The phenomenon where two (2) dominant alleles affect the phenotype in separate, distinguishable ways.

2.11 The external appearance of the gene.

2.12 If the two (2) alleles at a locus of a particular homologous chromosome pair differ.

2.13 The development in animals where at birth the young are maybe blind, hairless, and essentially helpless.

2.14 The extra-embryonic membrane which works to dispose of waste products and contributes to gas exchange.

2.15 The type of cleavage where complete division of the egg occurs.

2.16 LH regulates these cells, which secrete testosterone and other androgen hormones.

2.17 The production of GnRH is regulated by this hormone.

2.18 The process whereby the oviducts are tied to prevent fertilization.

QUESTION 3 **[19]**

3.1 Draw a labelled diagram to explain the process used to clone the sheep Dolly. (9)

3.2 Draw and label a small section of a DNA molecule to represent its structure clearly. (8)

3.3 The research and discovery of DNA took many years. Briefly explain what T.H. Morgan's contribution was to this research. (2)

QUESTION 4 **[20]**

4.1 Study the following table and answer the questions that follow.

First Base	Second Base: U	Second Base: C	Second Base: A	Second Base: G	Third Base
U	UUU, UUC Phe; UUA, UUG Leu	UCU, UCC, UCA, UCG Ser	UAU, UAC Tyr; UAA Stop; UAG Stop	UGU, UGC Cys; UGA Stop; UGG Trp	U C A G
C	CUU, CUC, CUA, CUG Leu	CCU, CCC, CCA, CCG Pro	CAU, CAC His; CAA, CAG Gin	CGU, CGC, CGA, CGG Arg	U C A G
A	AUU, AUC, AUA Ile; AUG Met or Start	ACU, ACC, ACA, ACG Thr	AAU, AAC Asn; AAA, AAG Lys	AGU, AGC Ser; AGA, AGG Arg	U C A G
G	GUU, GUC, GUA, GUG Val	GCU, GCC, GCA, GCG Ala	GAU, GAC Asp; GAA, GAG Glu	GGU, GGC, GGA, GGG Gly	U C A G

The tRNA sequence during a protein synthesis process is as follow:

GGG ACU AAU UAA CCU

Give the:

4.1.1 DNA coding strand (2½)

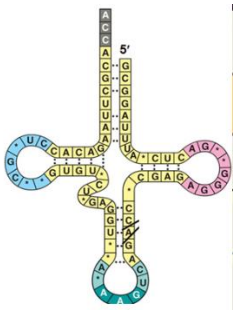
4.1.2 mRNA sequence (2½)

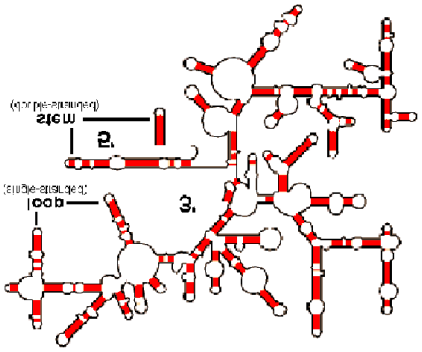
4.1.3 DNA template strand (2½)

4.1.4 Amino acid sequence (2)

4.2 Name and briefly discuss the last stage of translation which occurs during the process of protein synthesis. (8)

4.3 Identify the following molecules. (2)

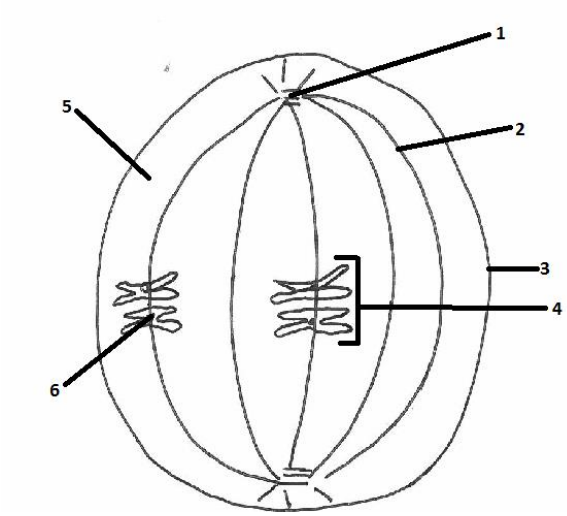
4.3.1 

4.3.2 

4.4 Name the sugar which forms part of a ribonucleotide. (½)

QUESTION 5 **[18]**

5.1 Study the diagram below and answer the questions that follow:



5.1.1 Which cell division process and phase is represented in the diagram? Give a visible reason for your answer. (3)

5.1.2 What phase occurs before the phase in the diagram? Draw detailed labelled diagrams to explain everything that happens during this phase. (9)

5.1.3 Supply labels for structures 1-6. (6)

QUESTION 6 (19)

1.1 Yellow fruit and dwarf vines are recessive traits in tomatoes. Red fruit and tall vines are dominant.

1.1.1 Complete a cross between a completely dominant red and tall plant crossed with a heterozygous red and dwarf plant. (Use the letter "T/t" for the colour of the fruit and the letter "H/h" for the size of the fruit). (15)

1.1.2 What percent of the offspring will be totally heterozygous? (1)

1.1.3 What is the phenotype ratio? (2)

1.1.4 What percent of the offspring will have yellow fruit and dwarf vines? (1)

QUESTION 7 **[19]**

7.1 Give a suitable definition for each of the following:

7.1.1 Budding (1)

7.1.2 Sexual reproduction (5)

7.1.3 Three (3) processes occur in an embryo after fertilization. Describe the first of these processes in detail, add diagrams to enhance your description. (13)

QUESTION 8 **[19]**

8.1 What are the differences between female gamete production and male gamete production. Include the names of these two (2) processes. (6)

8.2 In each of the following cases, give the function of the hormone, mention where the hormone is produced and where does the hormone functions.

8.2.1 Gonadotropin-releasing hormone (in females) (3)

8.2.2 Follicle stimulation hormone (in females) (3)

8.2.3 Testosterone (3)

8.3 Two (2) cycles of female reproduction include the changes in the uterus called the uterine cycle and the changes in the ovaries called the ovarian cycle. Briefly describe the latter cycle. (8 x ½ = 4)

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