



**FACULTY OF SCIENCE**

**DEPARTMENT BIOCHEMISTRY**

**LS3AFET**

**LIFE SCIENCE 3A FET**

**APK CAMPUS**

**JUNE EXAM (UNITS: 1-6)**

**13 JUNE 2014**

**DATE:** 13 JUNE 2014  
**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: 12 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****[12]**

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 A pedigree analysis for a given disorder's occurrence in a family shows that, although both parents of an affected child are normal, each of the parents has had affected relatives with the same condition. The disorder is then which of the following?
- A) Recessive
  - B) Dominant
  - C) Incompletely dominant
  - D) Maternally inherited
  - E) A new mutation
- 1.2 Black fur in mice (B) is dominant to brown fur (b). Short tails (T) are dominant to long tails (t). What fraction of the progeny of the cross  $BbTt \times BBtt$  will have black fur and long tails?
- A) 1/16
  - B) 3/16
  - C) 3/8
  - D) 1/2
  - E) 9/16
- 1.3 Regeneration, the regrowth of lost body parts, normally follows \_\_\_\_\_
- A) all types of asexual reproduction.
  - B) all types of sexual reproduction.
  - C) fission.
  - D) fragmentation.

- E) parthenogenesis.
- 1.4 An advantage of asexual reproduction is that \_\_\_\_\_
- A) asexual reproduction allows the species to endure long periods of unstable environmental conditions.
  - B) asexual reproduction enhances genetic variability in the species.
  - C) asexual reproduction enables the species to rapidly colonize habitats that are favourable to that species.
  - D) asexual reproduction produces offspring that respond effectively to new pathogens.
  - E) asexual reproduction allows a species to readily rid itself of harmful mutations.
- 1.5 An oocyte released from a human ovary enters the oviduct as a result of \_\_\_\_\_
- A) the beating action of the flagellum on the oocyte.
  - B) the force of the follicular ejection directing the oocyte into the oviduct.
  - C) the wavelike beating of cilia lining the oviduct.
  - D) movement of the oocyte through the pulsing uterus into the oviduct.
  - E) Peristaltic contraction of ovarian muscles.
- 1.6 The junction of the upper vagina and the uterus is called the \_\_\_\_\_
- A) fallopian tube.
  - B) clitoris.
  - C) oviduct.
  - D) labia majora.
  - E) cervix.
- 1.7 What is meant by the description "antiparallel" regarding the strands that make up DNA?

- A) The twisting nature of DNA creates nonparallel strands.
- B) The 5' to 3' direction of one strand runs counter to the 5' to 3' direction of the other strand.
- C) Base pairings create unequal spacing between the two DNA strands.
- D) One strand is positively charged and the other is negatively charged.
- E) One strand contains only purines and the other contains only pyrimidines.
- 1.8 Which of the following investigators was/were responsible for the following discovery?  
In DNA from any species, the amount of adenine equals the amount of thymine, and the amount of guanine equals the amount of cytosine.
- A) Frederick Griffith
- B) Alfred Hershey and Martha Chase
- C) Oswald Avery, Maclyn McCarty, and Colin MacLeod
- D) Erwin Chargaff
- E) Matthew Mendelsohn and Franklin Stahl
- 1.9 A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA transcribed is
- A) 3' UCA 5'.
- B) 3' UGA 5'.
- C) 5' TCA 3'.
- D) 3'ACU 5'.
- E) either UCA or TCA, depending on wobble in the first base.
- 1.10 Use the diagram below to answer this question. What is the sequence of a peptide based on the following mRNA sequence?

5' . . . UUUUCUUAUUGUCUU 3'

- A) leu-cys-tyr-ser-phe
- B) cyc-phe-tyr-cys-leu
- C) phe-leu-ile-met-val
- D) leu-pro-asp-lys-gly
- E) phe-ser-tyr-cys-leu

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

- 1.11 After telophase I of meiosis, the chromosomal makeup of each daughter cell is \_\_\_\_\_
- A) diploid, and the chromosomes are each composed of a single chromatid.
  - B) diploid, and the chromosomes are each composed of two chromatids.
  - C) haploid, and the chromosomes are each composed of a single chromatid.
  - D) haploid, and the chromosomes are each composed of two chromatids.

- E) tetraploid, and the chromosomes are each composed of two chromatids.
- 1.12 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 the amount of DNA.
- B) They have half the number of chromosomes and half the amount of DNA.
- C) They have the same number of chromosomes and half the amount of DNA.
- D) They have half the number of chromosomes and one-fourth the amount of DNA.
- E) They have half the amount of cytoplasm and twice the amount of DNA.

**QUESTION 2**

**[12]**

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 process that can be achieved by dusting one plant with pollen from another.
- 2.2 The genetic law which states that each pair of alleles segregates independently from another pair of alleles during gamete formation.
- 2.3 The type of development, if at birth the young may be well-developed and able to move about at once.
- 2.4 The extraembryonic membrane found in amniotes which assists in gas exchange.
- 2.5 The release of an egg cell from the follicle.
- 2.6 The gland which secretes a clear mucus before ejaculation that neutralizes acidic urine remaining in the urethra of a man.
- 2.7 The enzyme which breaks, swivels and re-joins the parental DNA ahead of the replication fork, to prevent over winding during DNA replication.
- 2.8 The enzyme which adds free DNA nucleotides to the RNA primer 3' carbon during DNA replication.

- 2.9 Noncoding regions on an mRNA strand.
  - 2.10 The nitrogenous base found in DNA and not in RNA.
  - 2.11 Alternative name for sex chromosomes.
  - 2.12 The fusion process of a sperm nucleus and an egg nucleus.
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**QUESTION 3**

**[21]**

- 3.1 A man with type A blood marries a woman with type B blood. Their child has type O blood. What are the genotypes of these individuals? What other genotypes and phenotypes, and in what frequencies, would you expect the offspring from this marriage to have? (20 x ½ = 10)
- 3.2 Match each term on the left with a statement on the right. (12 x ½ = 6)

<b><u>Term</u></b>	<b><u>Statement</u></b>
1) Gene	A) An alternative version of a gene
2) Allele	B) A variant for a character
3) Character	C) A cross between individuals heterozygous for a single character
4) Trait	D) A heritable feature that varies among individuals
5) Dominant allele	E) A heritable unit that determines a character and can exist in different forms.
6) Recessive allele	F) Having two identical alleles for a gene
7) Genotype	G) Determines phenotype in a heterozygote
8) Phenotype	H) Has no effect on phenotype in a heterozygote
9) Homozygous	I) An organism's appearance or observable traits

10) Heterozygous J) The genetic makeup of an individual

11) Testcross K) A cross between an individual with an unknown genotype and a homozygous recessive individual

12) Monohybrid cross L) Having two different alleles for a gene

3.3 Name and briefly discuss the different degrees of dominance, include examples to substantiate your answer. (5)

**QUESTION 4**

**[21]**

4.1.1 During the embryonic development of a frog, the zygote undergoes several rapid divisions. What is this process called and what structure is the result of this process?(2)

4.1.2 The structure formed in question 4.1.1 (answered structure) will then undergo a second process whereby some of the cells of the structure migrates inwards. What is this process called and what structure is the result of this process? (2)

4.1.4 Draw and label the structure answered in question 4.1.2. Remember the question relates to a frog. (8)

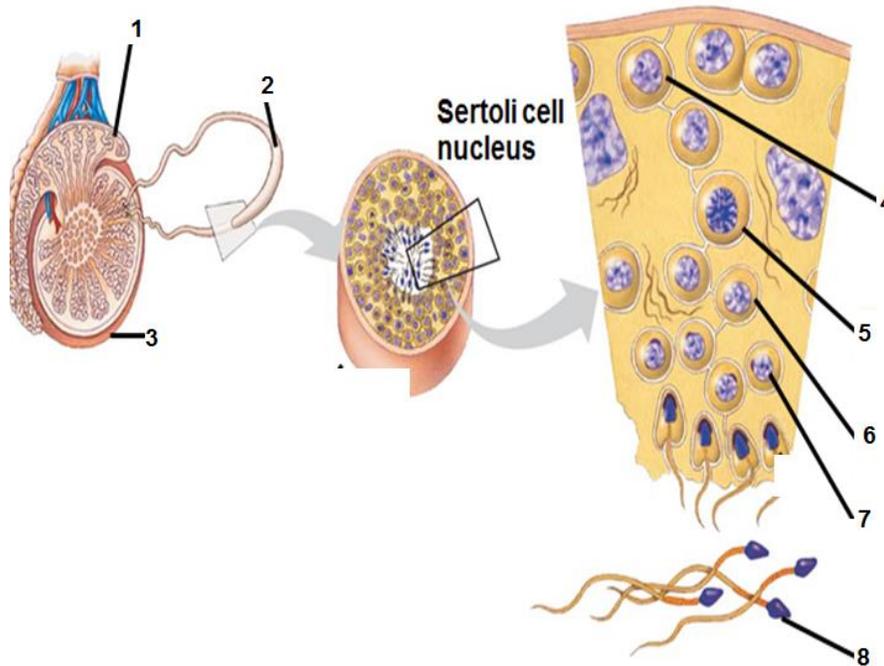
4.2 Describe the first metabolic reaction that takes place during the process of fertilization. (6)

4.3 All fertilization requires is critical timing. Name three (3) factors which mediate this process. (3)

**QUESTION 5**

[21]

5.1 The diagram below shows a representation of the process of the production of mature sperm. Study this diagram and answer the questions that follow.



5.1.1 Which process is represented by the diagram above? (one word term) (1)

5.1.2 Label structures 1 – 8. (8)

5.1.3 Draw and label a details cross section through the structure numbered 8. ( 8 x 4 = 4)

5.2 Briefly discuss the differences between the process represented by the diagram in question 5.1 and the process of the production of mature ova. (6)

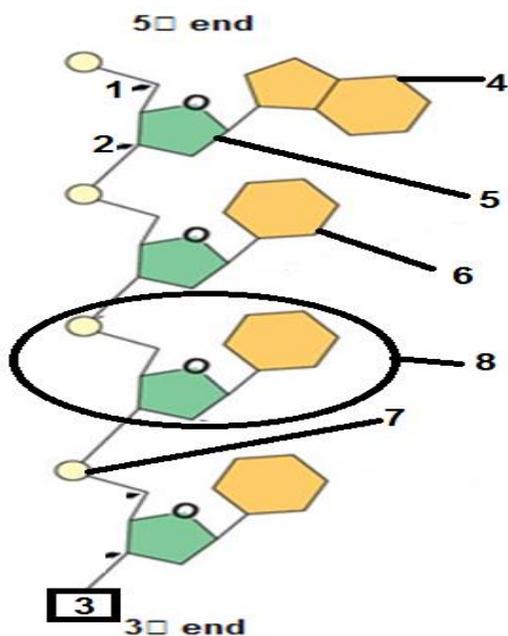
5.3 Name the cells in the testis which produce testosterone, and name the hormone which regulates these cells. (2)

**QUESTION 6**

(21)

6.1 Describe how insulin is produced using DNA cloning. (15)

6.2 Study the diagram below which represents one (1) strand of a DNA molecule and answer the questions that follow.



6.2.1 Label parts 1,2,3,5,7 and 8. (6 x ½ = 3)

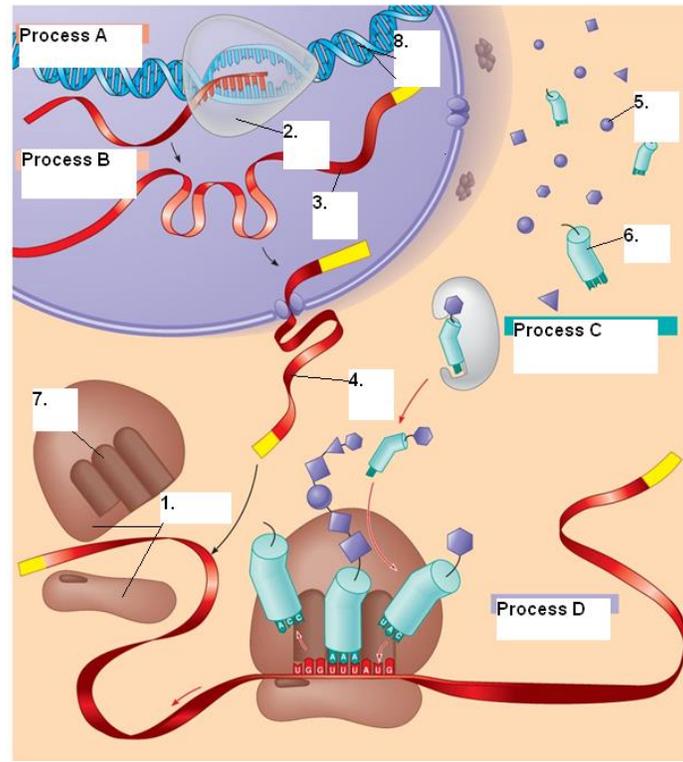
6.2.2 Structure 4 can be any one (1) of two (2) structures. Name them and give a reason for your answer. (3)

**QUESTION 7** **[21]**

7.1 How is the pre-m-RNA modified in Eukaryotic cells before translation can begin? (6)

7.2 tRNA's are specific to their function. By referring to this statement, how do t-RNA molecules differ? (3)

7.3 Study the diagram of protein synthesis and answer the questions that follow.



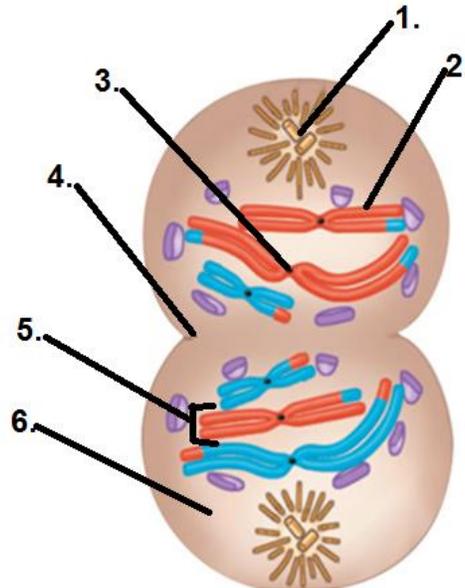
7.3.1 Label the processes A and D and label structures 1 – 8. (10 x ½ = 5)

7.3.2 Discuss the initiation and elongation phases of process D in detail. (7)

**QUESTION 8**

[21]

8.1 Study the diagram below and answer the questions that follow.



8.1.1 The diagram show one of the phases in the process used to make gametes. Name this process. (1)

8.1.2 Which phase is represented by the diagram above? (1)

8.1.3 Label structures one (1) to six (6). (6)

8.1.4 Name, draw and label a diagram to represent the phase that precedes the phase in the diagram. (5)

8.2 Why do sex chromosome abnormalities tend to be less severe than autosome abnormalities? (2)

8.3 What is non-disjunction? (2)

8.4 Discuss the term karyotype. (4)

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