FACULTY OF SCIENCE

DEPARTMENT OF BOTANY AND PLANT BIOTECHNOLOGY

LSFT0A3/ LS3AFET

LIFE SCIENCE 3A FET

APK CAMPUS

SEMESTER TEST 2 (UNITS: 4-6)

MEMORANDUM

15 MAY 2017

DATE:	**15 MAY 2017**
SESSION:	**10H30-12:00**
ASSESSOR:	**MS J. WILLIAMSON**
INTERNAL MODERATOR :	**DR. A. NEL**
DURATION:	**1½ HOURS**
TOTAL MARKS:	**90**

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 **[15]**

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 pea plant is heterozygous at the independent loci for flower colour (white versus purple) and seed colour (yellow versus green). What types of gametes can it produce?

A. Two (2) gamete types: white/white and purple/purple.
B. Two (2) gamete types: white/yellow and purple/green.
C. <u>Four (4) gamete types: white/yellow, white/green, purple/yellow, and purple/green.</u>
D. Four (4) gamete types: white/purple, yellow/green, white/white, and purple/purple.
E. One (1) gamete type: white/purple/yellow/green.

1.2 ABO blood type in humans exhibits codominance and multiple alleles. What is the likelihood of a type A father and a type A mother having a type O child?

A. It is impossible.
B. <u>25% if both parents are heterozygous.</u>
C. 50% if both parent are heterozygous.
D. 25% if only the father is heterozygous.
E. 25% if only the mother is heterozygous.

1.3 Cystic fibrosis (CF) is a Mendelian disorder in the human population that is inherited as a recessive. Two (2) normal parents have two (2) children with CF. The probability of their next child being normal for this characteristic is which of the following?

A. 0

B. 1/2

<u>C. 1/4</u>

D. 3/4

E. 1/8

1.4 Which of the following is an example of polygenic inheritance?

A. Pink flowers in snapdragons.

B. The ABO blood groups in humans.

C. Huntington's disease in humans.

D. White and purple flower colour in peas.

E. Skin pigmentation in humans.

1.5 Which of the following terms best describes when the phenotype of the heterozygote differs from the phenotypes of both homozygotes?

A. Incomplete dominance

B. Multiple alleles

C. Pleiotropy

D. Epistasis

1.6 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.

1.7 Cleavage of the zygote begins in the _____

A. ovary.

B. uterus.

C. vagina.

D. oviduct.

E. endometrium.

1.8 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.

1.9 The vertebrate ectoderm is the origin of the _____

A. nervous system.

B. liver.

C. pancreas.

D. heart.

E. kidneys.

1.10 Contact of a sperm with signal molecules in the coat of an egg causes the sperm to undergo _____

A. mitosis.

B. depolarization.

C. apoptosis.

D. vitellogenesis.

E. the acrosomal reaction.

1.11 In humans, the follicular cells that remain behind in the ovary following ovulation become____

A. ovarian endometrium shed at the time of menses.

B. a steroid-hormone synthesizing structure called the corpus luteum.

C. the thickened portion of the uterine wall.

D. swept into the fallopian tube.

E. the placenta, which secretes cervical mucus.

1.12 Testosterone is synthesized primarily by the _____

A. sperm cells.

B. hypothalamus.

C. Leydig cells.

D. anterior pituitary gland.

E. seminiferous tubules.

1.13 In correct chronological order, the three (3) phases of the uterine cycle are _____

A. menstrual → ovulation → luteal

B. follicular → luteal → secretory

C. menstrual → proliferative → secretory

D. follicular → ovulation → luteal

E. proliferative → luteal → ovulation

1.14 Ovulation is the follicular response to a burst of secretion of _____

A. LH.

B. progesterone.

C. inhibin.

D. prolactin.

E. estradiol.

1.15 The secretion of follicle stimulating hormone from the pituitary is reduced by _____

A. inhibin.

B. luteinizing hormone.

C. oxytocin.

D. prolactin.

E. vasopressin.

QUESTION 2 **[15]**

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 gene which codes for the development of testes. **SRY gene**

2.2 Cystic fibrosis is an example of this genetic phenomenon. **Pleiotropy**

2.3 The phenomenon which describes a cross between a black dog and a white dog giving birth to white puppies with black spots. **Codominance**

2.4 When the two (2) alleles at a locus on a homologous chromosome pair are identical. **Homozygous**

2.5 The ratio of the F2 generation when true breeding purple and white flowers cross. **3:1**

2.6 The type of embryonic development found in elephants. **Precocial development**

2.7 The embryonic membrane which assists in gaseous exchange during amniote development. **Chorion**

2.8 The embryonic layer which develops into the dermis of the skin. **Mesoderm**

2.9 The type of cleavage found in sea urchins**. Holoblastic cleavage**

2.10 The process by which an animal takes shape. **Morphogenesis**

2.11 The assisted reproductive technology where sperm are injected directly into an egg. **intracytoplasmic sperm injection (ICSI)**

2.12 The hormone which prevents menstruation. **Human chorionic gonadotropin (hCG)**

2.13 The cells which secrete the hormone inhibin. **Sertoli cells**

2.14 The head of the penis. **Glans**

2.15 The gland which secretes a clear mucus before ejaculation that neutralizes acidic urine remaining in the urethra. **Bulbourethral glands**

QUESTION 3 **[20]**

In humans, colour-blindness is due to the recessive allele (a), and normal vision is due to the dominant allele (A). What is the expected offspring between a normal man and a colour-blind woman? Give both genotypic and phenotypic ratios. Show cross in detail.

(20)

P1 X^aX^a **x** X^AY

Meiosis

Gametes X^a X^a X^A **Y**

Fertilization

	X^a	X^a
X^A	$X^a X^A$	$X^a X^A$
Y	X^a **Y**	X^a **Y**

F2 generation

Genotype: **2 x $X^a X^A$**

2 x X^a Y

Phenotype: **2 x carrier girls**

2 x colour-blind boys

Ratio for genotype 1:1

Ratio for phenotype 1:1

QUESTION 4 **[20]**

4.1 "All animals ensure the survival of their offspring" Discuss this statement (7)

- **All species produce more offspring than the environment can handle.**
- **The proportion that survives is small.**
- **Species with external fertilization produce more gametes than species with internal fertilization.**
- **Species with internal fertilization provide greater protection of the embryos and more parental care.**
- **The embryos of some terrestrial animals develop in amniote eggs with protective layers.**
- **Other animals retain the embryo, which develops inside the female.**
- **In many animals, parental care helps ensure survival of offspring.**

4.2 Give a suitable definition for each of the following terms:

4.2.1 Parthenogenesis: (2)

- **Is the development of a new individual from an unfertilized egg**
- **It involves the doubling of chromosomes after meiosis**

4.2.2 Hermaphroditism (½)

- **Where each individual has male and female reproductive systems**

4.2.3 Cloaca (1)

Common opening between the external environment and the digestive, excretory, and reproductive systems

4.3 Fill in the missing words to explain the three (3) processes which occur during fertilization. (Only write down the correct answer next to the appropriate letter)

(19 x ½ = 9½)

(**The first process during fertilization)–(a)- Acrosomal reaction** occurs in the following way:

- **(b)Sperm** contacts **(c)egg.**

- **(d)Acrosome** releases **(e)hydrolytic enzymes** which digest the egg jelly coat.
- **(f)Actin filaments** of acrosomal process binds to the **(g)sperm binding receptors.**
- **(h)Plasma membranes** of sperm and egg fuses.
- Sperm releases **(i)haploid nucleus** in egg cytoplasm to cause a fast block to prevent **(j)polyspermy.**

(The second process of fertilization) - (k)The Cortical reaction occurs in the following way:

- It is initiated by the fusion of egg and sperm.
- It causes a rise in **(l)Ca2+/ calcium ions.**
- This stimulates **(m)cortical granules** to release their contents outside the egg.
- This cause the formation of a **(n)fertilization envelope** (functions as a slow block to **(o)polyspermy**.)

(The third process of fertilization) – (p) -activation of the egg takes place in the following way:

- The sharp rise in **(q)Ca2**+ in the egg's cytosol increases the rates of **(r)cellular respiration** and **(s)protein synthesis** by the egg cell.
- Now the egg is said to be activated.

QUESTION 5 **[20]**

5.1 Briefly discuss the basis on which contraceptives work. (3)

- **Contraceptive methods fall into three categories:**
  - **Preventing release of eggs and sperm**
  - **Keeping sperm and egg apart**
  - **Preventing implantation of an embryo**

5.2 When is an embryo called a fetus? (1)

When all the major structures (organs) are present, at 8 weeks.

5.3 How is the placenta formed? (2)

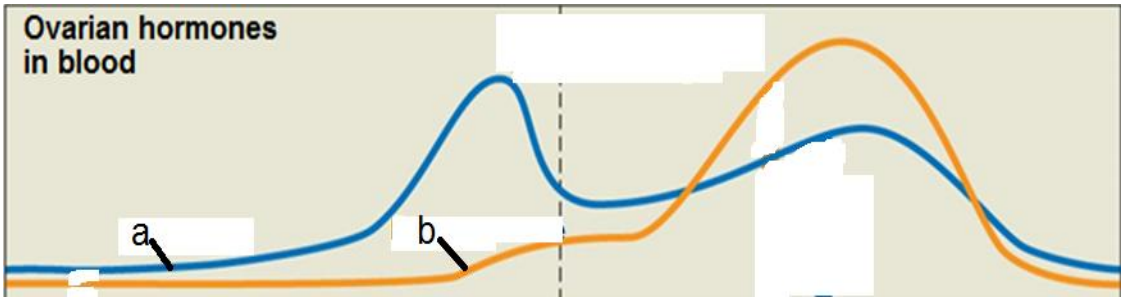
- **The outer layer of the blastocyst, called the trophoblast,**

- **mingles with the endometrium**
- **and eventually forms the placenta**

5.4 Explain briefly how blood travels between the embryo to the placenta. (2)

- **Blood from the embryo travels to the placenta through arteries of the umbilical cord**
- **and returns via the umbilical vein**

5.5 Study the following graph which shows the amount of ovarian hormones in the blood and answer the questions that follow.



5.5.1 Label a and b. (2)

a – estrogen/estradiol b – progesterone

5.5.2 Which pituitary gonadotropin also surges (increase in concentration) at approximately the same time as ovarian hormone a? (1)

LH –Luteinizing hormone

5.5.3 What is the functioning of ovarian hormones a and b? (2)

Prepare endometrium for possible implantation of the embryo by thickening the endometrium – supplying it with blood.

5.5.4 What phase in the uterine cycle occurs when both ovarian hormone levels are low?(1)

Menstual phase

5.5.5 What is the result of the extreme increase in the concentration of the hormone answered in question 5.5.2? (1)

Ovulation (release of the secondary oocyte)

5.6 Answer the following questions about spermatogenesis.

5.6.1 Which process converts the Primary spermatocyte into a secondary spermatocyte? (1)

Meiosis 1

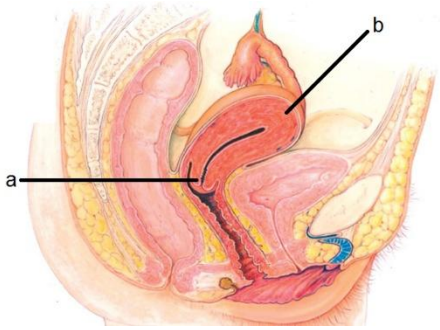
5.6.2 Which cells are responsible for nourishing the spermatids during differentiation? (1)

Sertoli cells

5.6.3 Which cells start the process of spermatogenesis? (1)

Primordial germ cells in the embryo

5.7 Study the female reproductive system below and answer the questions that follow.



5.7.1 Label a and b (2 x ½ = 1)

a – cervix b - Uterus

5.7.2 What is the lining of structure b called? What disease do women suffer from if this lining is swollen and infected? (2 x ½ = 1)

Endometrium - Endometriosis

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