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UNIVERSITY OF SWAZILAND

MAIN EXAMINATION PAPER: MAY 2017

TITLE OF PAPER: APPLIED BIOLOGY

COURSE CODE: B405

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:
1. THIS PAPER IS DIVIDED INTO FOUR SECTIONS
2. ANSWER A TOTAL OF FOUR QUESTIONS, CHOOSING ONE QUESTION FROM EACH SECTION AND USING SEPARATE ANSWER BOOKLETS FOR EACH SECTION.
3. EACH QUESTION CARRIES TWENTY FIVE (25) MARKS
4. ILLUSTRATE YOUR ANSWER WITH LARGE AND CLEARLY LABELLED DIAGRAMS WHERE APPROPRIATE

SPECIAL REQUIREMENTS: NONE

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATORS

SECTION A (Answer **one** question from this section). 103

Question 1

Review the major reasons for the emergence of new infectious diseases. What methods are available for identifying and controlling the emergence of new infectious diseases? (25 marks)

Question 2

Determine the role of industrial microbiology in the socio-economic development of the Kingdom of Swaziland. (25 marks)

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SECTION B (Answer **one** question from this section)

Question 3

For each of the activities below, use examples to identify a life support system associated with them. Briefly discuss and indicate how the identified system is affected.

(i). Nutrient enrichment, (5 marks)
(ii). Introduction of non-native species, (5 marks)
(iii). Overharvesting, (5 marks)
(iv). Habitat destruction & degradation, (5 marks)
(v). Intensive agriculture. (5 marks)

[Total marks = 25]

Question 4

Compare traditional and modern (monocropped) agroecosystems. Which system has a higher ecological footprint and why? (25 marks)

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SECTION C (Answer **one** question from this section)

Question 5

Consider the three case studies below and answer the questions that follow.

Case study 1

Remains of a person, believed to be those of Mr Farai Ncube who went missing a two years ago in Nhlangano, were found in a shallow grave just 100 metres away from his homestead. Mr Ncube left behind a wife (Mufaro) and three daughters (Tawanda, Rudo and Temaswati). Microsatellite fingerprints of Mufaro and her daughters are given below.

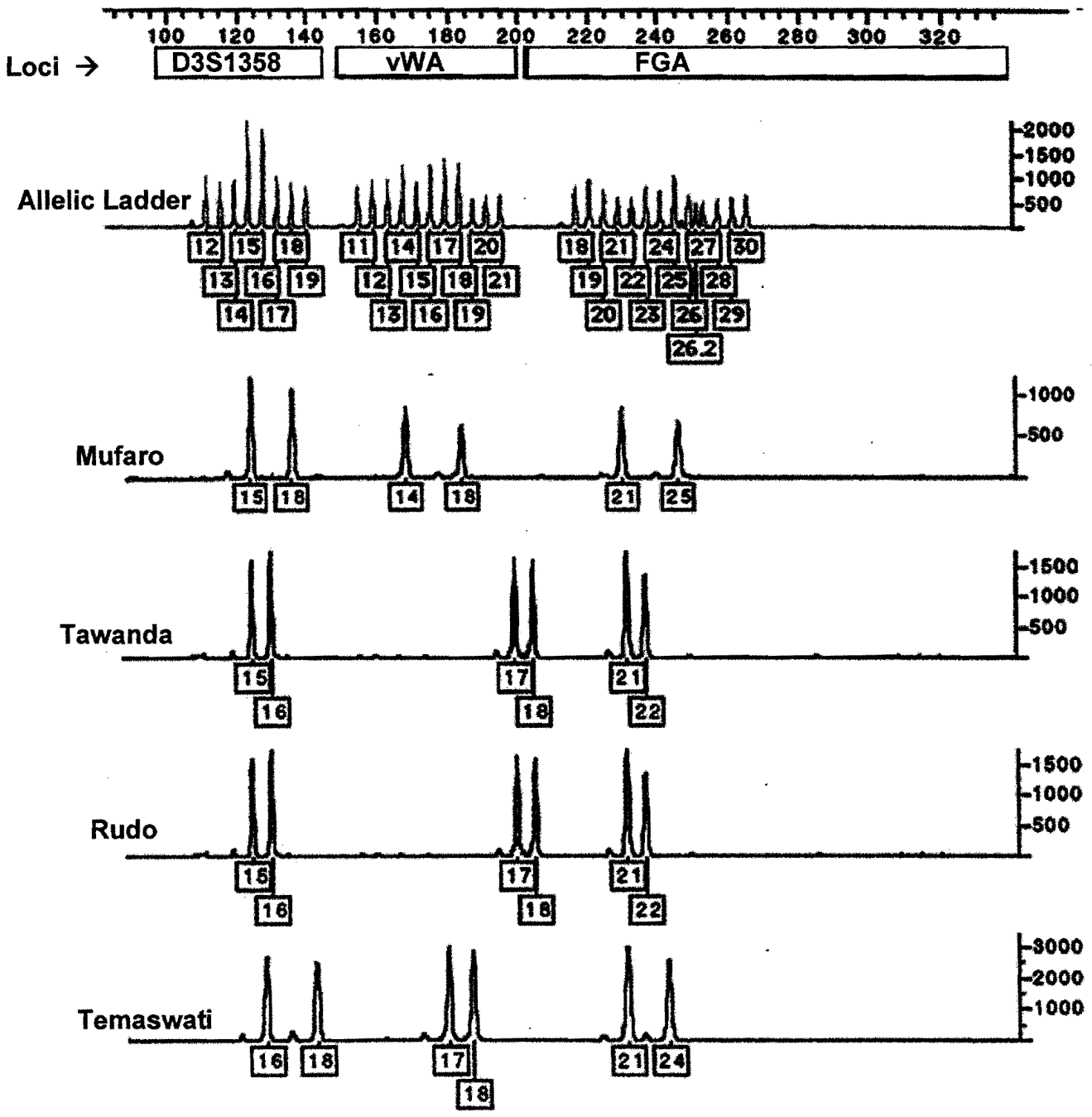

Fig 1: Microsatellite profiles for Mufaro and her daughters

Case study 2

A civil war in Sudan displaced a lot of families and separated or scattered family members into different locations. Three siblings comprising two brothers (Rajid and Asaad) and one sister (Melissa) decided to identify their parents from whom they got separated 25 years ago. They found a couple who resembled their parents (from old pictures they kept in a family album) but to be sure, they had to do DNA fingerprinting of themselves and the suspected parents. They used five (5) autosomal microsatellite loci and the children's profiles are as given in Table1 below.

Table 1: Microsatellite profiles for three siblings.

Locus	Rajid	Asaad	Melissa
D3S1358	18, 18	18, 18	15, 16
vWA	16, 18	16, 18	16, 17
D8S1179	13, 15	13, 15	13, 15
THO1	9.3, 10	9.3, 10	6, 9.3
CSF1PO	12, 12	11, 12	12, 12

Case study 3

Three people, Jabulani "JB", Mgadzi and Bonsile are involved in a love triangle where a baby girl is a subject of a paternity wrangle between Bonsile and Mgadzi. Bonsile, the mother of the girl, alleges that Mgadzi is the biological father, an allegation he vehemently disputes citing his knowledge of JB's possibility as a father. Bonsile knows very well that JB is the true father of her child, but because he doesn't have a well-paying job, she prefers to pin Mgadzi and stick to him as the man responsible for her daughter. In your forensics lab you take DNA samples from the above four people.

(a) (i) Explain what is meant by DNA fingerprinting. (1 mark)
(ii) Explain the role of the allelic ladder in Fig 1. (1 mark)
(iv) At locus **FGA,** explain what the number "**26**" represents. (1 mark)
(v) Explain the advantage(s) of the marker used in **Case study 1**. (4 marks)

(b) Do the microsatellite profiles in Fig 1 support the fact that the remains found in the shallow grave are those of Mr Farai Ncube? Explain your answer, giving Mr Ncube's likely DNA fingerprint (if possible). Also indicate how you would forensically determine the gender of the person found in the grave. (6 marks)

(c) Use the STR alleles in Table 1 to decipher the possible genotypes of the parents. (6 marks)

(d) With reference to case 3, explain how you would unequivocally exonerate Mgadzi from Bonsile's paternity fraud. (6 marks)

[TOTAL MARKS = 25]

Question 6

Evaluate application of serum (iso)enzymes in clinical pathology. (25 marks)

SECTION D (Answer **one** question from this section) 107

Question 7

Supposed you are a government official in charge *of Swaziland Parks Agency* and your budget allocation is E20 million. Provide practical and ecologically sound justifications for the percentage of your budget that you would allocate to the following missions:

a) conducting species inventories, (8 marks)
b) determining ecosystems at risk, (8 marks)
c) protected area design studies. (9 marks)

[TOTAL MARKS = 25]

Question 8

Conservation values and targets are not static, but change through time as societal values themselves change. Our attitude towards top predators (leopards and hyaena) in Swaziland is a good example. Critically examine one example of how conservation values and targets might change over the next 50 years (25 marks)

END OF QUESTION PAPER