MATRIC LIFE SCIENCES PAPER 1 2009: MEMORANDUM

Tissues, cells & molecular studies and Life Systems

SECTION A
QUESTION 1

1.1.1 C √√
1.1.2 D√√
1.1.3 A√√
1.1.4 A√√
1.1.5 C√√ 5 x 2 **(10)**

1.2.1 chiasmata √
1.2.2 heterozygous √
1.2.3 phenotype √
1.2.4 bivalent or homologous chromosomes √
1.2.5 amniocentesis √
1.2.6 prolactin √
1.2.7 spermatogenesis √
1.2.8 mutation √ 8 x 1 **(8)**

1.3.1 C √
1.3.2 E √
1.3.3 B√
1.3.4 A√
1.3.5 D√ 5 x 2 **(5)**

1.4.1 C, E, D, B, F, A One mark (√) each (6)
1.4.2 Crossing over increases variation√ in the gametes or offspring.√ (2)
1.4.3 E √ (1)
1.4.4 In anaphase I chromosomes are double stranded.√ The chromosomes shown moving to the poles in diagram E are double stranded.√ (2)
(**11)**

1.5.1 umbilical vein √ (1)
1.5.2 Carbon dioxide √ and nitrogenous wastes, e.g. urea.√ (2)
1.5.3 The branched arrangement provides a large surface area**.**√√
The barrier between the foetal blood and the placenta is very thin to allow efficient diffusion.√√ (4)
(7)

1.6.1 18-20 days√ by looking at the period between maximum LH (or oestrogen) levels √ (2)
1.6.2 A high level of LH causes ovulation.√ After ovulation the corpus luteum forms and it begins secreting progesterone. √ (2)
1.6.3 A cow in calf produces milk, which would increase the farmer's profits.
OR
Beef farmers may want to increase the herd size to make more money. (2)
1.6.4 No.√ It is possible that the hormone can cross the placenta √ and have unwanted effects on the foetus. √
OR

Yes.√ It may cause a woman to produce more milk than usual during lactation √ and her baby would grow well.√ Other suitable arguments would also be acceptable. (3)

(9)

TOTAL FOR QUESTION 1: 50

SECTION B

QUESTION 2

2.1.1 **A** – pentose or deoxyribose sugar √ **B** – phosphate group √

C – nitrogenous base √ **D** – hydrogen bond √ (4)

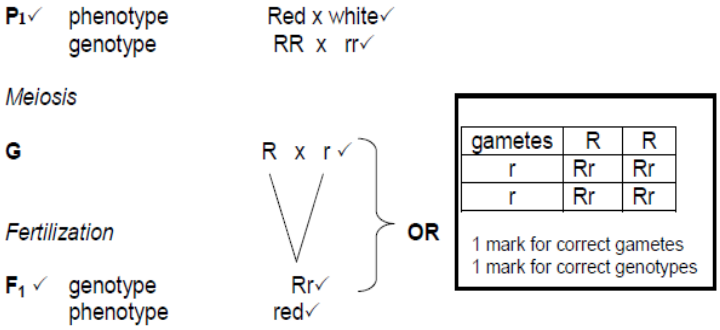
2.1.2 A nucleotide is made up of a nitrogenous base √, attached to one pentose sugar (deoxyribose or ribose),√ bound to a phosphate-bearing molecule.√ (3)

2.1.3 Table outlining the differences between DNA and RNA **(7)**

DNA	**RNA**
the sugar is deoxyribose	sugar is a ribose
molecule consists of a double strand of nucleotides, which can unzip	RNA with its single strand
thymine present	thymine absent, replaced by uracil
DNA strands are longer	RNA chains are much shorter

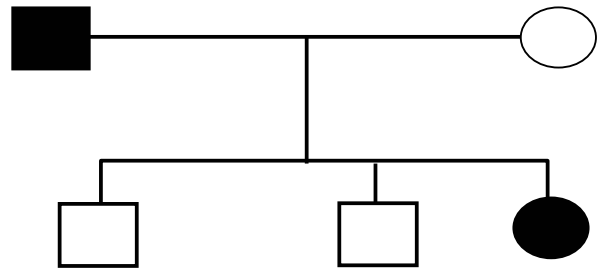
Any 3 differences 3 x 2 = 6 marks
Draw table with rows and columns = 1 mark

2.2 (6)



2.3.1 1 – X^HY √ 2 – X^HX^h √ 3 – X^hY √ 4 – X^HX^h √ (4)

2.3.2 a) Parents' phenotypes: haemophilic male x normal female carrier √



(3)

b) √√

Gametes	X^h	Y
X^H	X^HX^h	X^HY
X^h	X^hX^h	X^hY

50% chance of third son being haemophilic. √ (3) **(10)**

TOTAL FOR QUESTION 2: 30

QUESTION 3

3.1.1 Process N is transcription √.
DNA molecule unwinds and hydrogen bonds break, under the control of RNA polymerase.√ As the DNA strands separate, bases of free RNA nucleotides line up opposite exposed complementary bases on the coding strand;√ temporary hydrogen bonds form between bases.√ Adjacent RNA nucleotides join together to form a strand of mRNA.√ Hydrogen bonds between complementary bases break√ and the mRNA strand is free to leave the nucleus. (Maximum marks for description = 4) (5)

3.1.2 P – ribosome√; R – tRNA √ (2)

3.1.3 P is the organelle at which the mRNA "docks" to have the codons read.√
Each tRNA√ molecule brings its appropriate amino acid from the amino acid pool√ to the mRNA where the anticodon of a tRNA lines up with the codon on mRNA √ to create a string of appropriately ordered amino acids.√ Maximum marks for this description (4)
(11)

3.2.1 Sickle cell anaemia√ (1)

3.2.2

100% – (78+7+10)% = 5✓%

$\frac{5}{100}$ X $\frac{1200}{1}$✓

60✓ people
(3)

3.2.3 Parents may have the choice whether to abort the foetus or not OR counselling may prepare the parents for managing an affected child. (2)

(6)

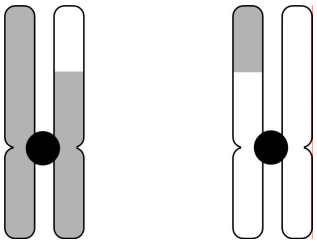
3.3.1 C – centromere√ D – chromatid √ (2)

3.3.2 They can only be seen with a microscope.√ (1)

3.3.3 Crossing over√ (1)

3.3.4 It ensures that genetic material is exchanged√ resulting in variation in the next generation.√ (2)

3.3.5



Mark allocation:
Chromosome drawn √
Chromosome has shaded and unshaded part in the correct proportion√
Neat and accurate drawing √
(3)

(10)

3.4.1 The older the woman, the less viable her eggs become,√ because her hormone levels have dropped.√ (2)

3.4.2 IVF should not be given to all couples who request it, as the older the woman, the smaller her chance of successfully conceiving.√ The data show that even in the age group where IVF is most successful, the success rate is only 28%.√ (2)

Argument must reflect interpretation of the data. For maximum marks to be awarded, data must be given. **(4)**

TOTAL FOR QUESTION 3: 30

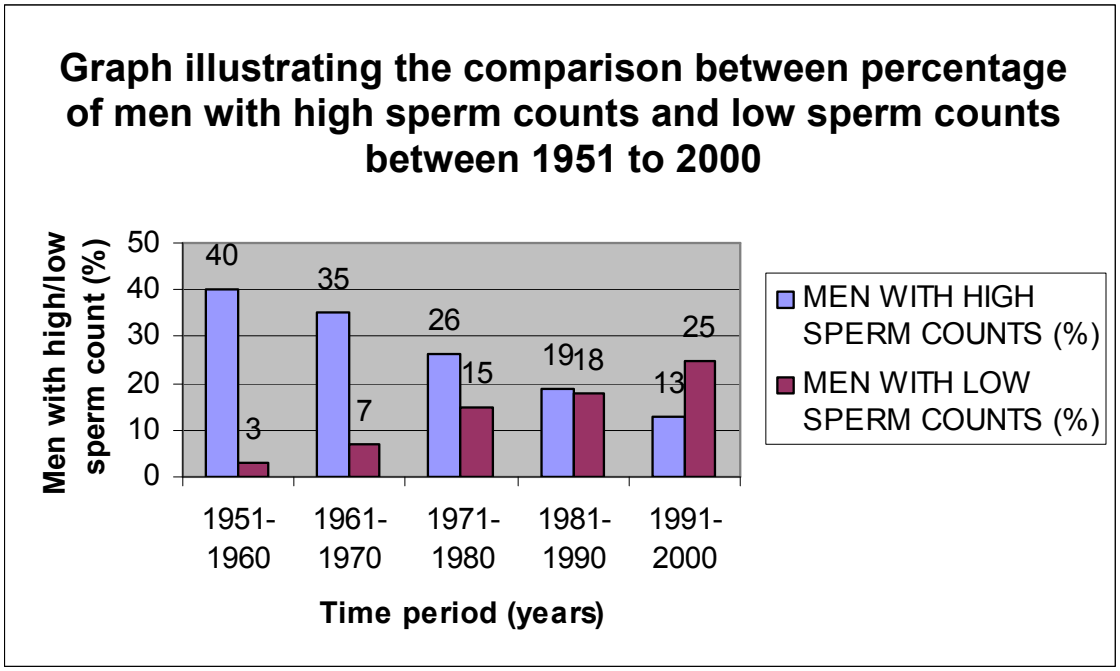
QUESTION 4

4.1.1 5% √ (1)

4.1.2 The percentage of men with low sperm counts has increased√ from 1951 to 2000. The percentage of men with high sperm counts has decreased√ from 1951 to 2000. (2)

4.1.3 The reason for the decline could be related to pollution levels√, or diet or age-related factors.√ (2)

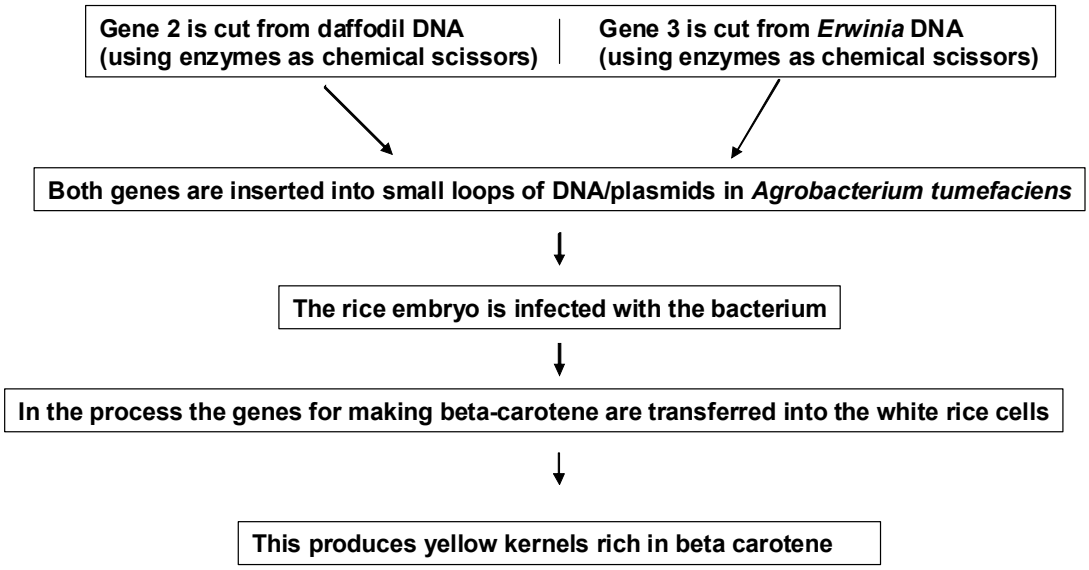
4.1.4



(11)

(16)

4.2.1 Flow diagram to show how genetic engineers transfer genes 2 and 3 into *Agrobacterium tumefaciens*√ √
vertical + fits on one page√ + 6 content



(9)

4.2.2 The four strategies must be clear strategies and be well worded, for example:

- subsidising the price of yellow rice seeds
- educating farmers
- running workshops at clinics and schools
- offering financial incentives for processing the rice
- any other logical answer that meets the criteria of the question.

The **four descriptions** must match the identified strategies and give sufficient information to make sense of how the strategy would be implemented.

- Subsidising the price of yellow rice seeds so that the seed would be affordable to rural farmers and therefore would be preferred to the cheaper white rice seeds.
- Educating farmers about the value of yellow miracle rice compared to white rice. Their families would be healthier, thereby saving them money. It could also bring them greater income, as the demand for this type of rice would increase.
- Running workshops at clinics and schools to encourage women and children to opt for yellow miracle rice rather than white rice. As they are the main consumer market, it would be beneficial if they see and understand the benefits.
- Offer financial incentives such as free fertiliser or milling facilities to farmers who grow surplus yellow miracle rice. The farmers may want to switch to producing yellow rice for this reason, as well as health considerations.
- Any other logical answer that meets the criteria of the question.

Four arguments against the project. The answers must be clearly stated and relate to the information provided..

- Government funding is limited and cannot be used to subsidise yellow rice seed, owing to costs of health care, education, etc.
- People are bound by traditional ways and see this “new” rice as foreign. Choosing yellow rice would override the education process.
- There may be concerns about longterm side effects that might impact health or the environment.
- Having to buy new seeds each year will be an expense that will reduce profits. This is not the case when growing white rice.

- Any other logical argument against the project.

(15)

TOTAL FOR QUESTION 4: 40
GRAND TOTAL: 150