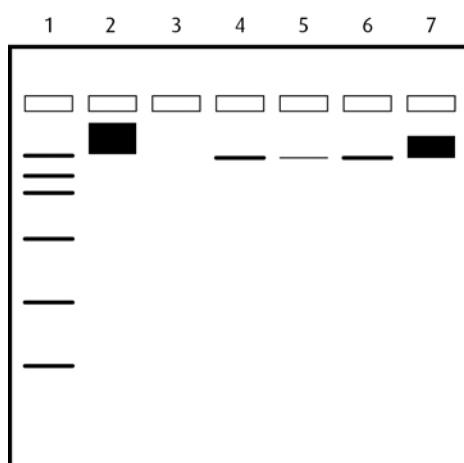


## Extension worksheet – Chapter 4

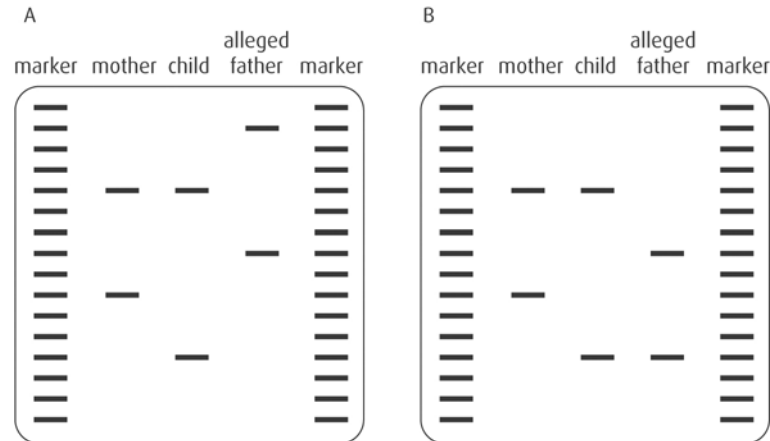
- 1** A gene controlling fur colour in cats is sex-linked. Two alleles, black and orange, occur on the X chromosome only:  $X^B$  = black pigment and  $X^O$  = orange pigment.
- So, black cats have the genotype  $X^B X^B$  (females) and  $X^B Y$  (males).
- Orange cats have the genotype  $X^O X^O$  (females) and  $X^O Y$  (males).
- Tortoiseshell (mixed orange and black) cats can only be female  $X^B X^O$ .
- a** What are the possible offspring of a black female cat and an orange male cat? Show the possible phenotypes and genotypes of the kittens. (4)
- b** A tortoiseshell female cat mated with an unknown male cat and produced six kittens: two were orange females, two were orange males, one was a black male and there was one tortoiseshell female. Deduce the genotype of the unknown male. (4)
- 2**
- a** Outline the main differences between mitosis and meiosis. (3)
- b** Explain why two brothers may not look alike but identical twins do look alike. (2)
- c** A couple have three children, all boys. They feel certain that their next child will be a girl. Do you think they are correct? Explain your answer. (2)
- d** What is non-disjunction and what is its effect in a gamete? (2)
- e** Cells that are collected during amniocentesis must be allowed to develop for a period of time before they can be used in karyotyping. Suggest why this is so. (2)
- 3** Study the DNA profile diagram below. It is a representation of the result of gel electrophoresis of DNA samples.



- a** Why do smaller DNA fragments travel further down the gel? (1)
- b** Suggest why the band in column 2 is thicker and darker than the other bands? (1)
- c** Suggest why there is no band in the third column. (1)



- d** Explain which of the alleged fathers (A or B) in the profiles below is most likely to be the parent of the child. (1)



- e** What is the purpose of the marker columns in each case? (1)
- 4 a** Explain the meanings of the following terms used in biotechnology and genetic engineering.
- i** transgenic organism (1)
  - ii** plasmid (1)
- b** How are the following enzymes used in biotechnology?
- i** restriction enzymes (endonucleases) (1)
  - ii** ligase (1)
- 5** Dolly the sheep was a cloned animal produced from an ovum that was not fertilised by a sperm. The ovum had its nucleus removed and replaced with the nucleus from a somatic cell from a donor sheep. The ovum containing this nucleus was allowed to develop in the uterus of a surrogate mother sheep.
- a** Dolly was a clone of which sheep?
- A** the sheep whose ovum was used
  - B** the sheep whose nucleus was used
  - C** the surrogate mother sheep
- Explain your answer. (2)
- b** How does the nucleus removed from the ovum differ from the nucleus from the donor sheep? (1)
- c** Outline the advantages of producing animal clones. (2)
- d** Give **two** disadvantages of the procedure. (2)