

**A level Biology A**  
**H420/03** Unified biology

**Question Set 3**

- 1 Tigers, *Panthera tigris*, are predatory mammals. They have evolved striped patterns on their fur, as shown in Fig. 3.1a, which provide camouflage in their habitats.



Fig. 3.1a

- (a) (i) Adaptations can be divided into three types.

State the type of adaptation represented by the tiger's stripes. [1]

**anatomical**

- (ii)\* Describe and explain how a tiger with striped fur may have evolved from a non-striped ancestor.

*In your answer you should discuss the different types of genes that might be involved in the creation of the striped pattern in the tiger's fur.* [6]

### Natural Selection

- mutations of pigment gene and regulatory gene
- selection pressure of prey availability
- adaptation helped tigers camouflage
- striped tigers had a greater survival probability and were more likely to reproduce
- beneficial alleles passed onto next generation
- allele frequency for relevant genes increase with each generation
- after many generations, all tigers within a population were striped

### Role Of Regulatory Genes

- regulatory genes control the pattern / where pigments produced or expression of genes
- genes switched on or off during development (epigenetic changes)
- recessive epistasis prevents expression of pigment gene

- (b) One subspecies of tiger is the Bengal tiger. One in 10000 Bengal tiger births results in a white Bengal tiger.

White Bengal tigers, as shown in Fig. 3.1b, have black stripes but lack orange fur.



Fig 3.1b

The allele that causes white fur is recessive and is a result of a mutation to a gene called SLC45A2.

According to the Hardy-Weinberg principle, the following equations can be used to estimate allele frequency within a population:

$$p^2 + 2pq + q^2 = 1$$

$$p + q = 1$$

Use the Hardy-Weinberg equations to calculate the percentage of Bengal tigers that are heterozygous for the SLC45A2 gene.

Give your answer to **one** significant figure.

Show your working.

$$p = 1 - 0.01 = 0.99$$

$$q^2 = 0.0001 \quad q = 0.01$$

$$2pq = 2 \times 0.99 \times 0.01 = 0.0198 \approx 0.02 = 2\%$$

Answer: ..... **2** ..... % [3]

## Total Mark for Questions Set 3: 10

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