Inheritance – A2 9700 Biology June 2022

1. June/2022/Paper_41/No.7

(a) The fruit fly, *Drosophila melanogaster*, usually has red eyes. A gene for eye colour has four alleles: red, apricot, honey and white.

Define the terms *gene* and *allele*.

gene .....

.....

allele .....

.....

[2]

(b)
- The allele for red eyes, C^R, is dominant to the other three alleles.
- The allele for apricot eyes, C^A, is dominant to the allele for honey eyes, C^H.
- The allele for white eyes, C^W, is recessive to the other three alleles.

Construct a genetic diagram to show the genotypes, phenotypes and ratio of the offspring from a cross between a fruit fly with red eyes, C^RC^H, and a fruit fly with apricot eyes, C^AC^W.

parents phenotypes	red eyes	apricot eyes
parents genotypes	C^RC^H	C^AC^W
gametes		
offspring genotypes		
offspring phenotypes		
ratio		

[3]

(c) Describe how you would carry out a test cross **and** use it to determine the genotype of a red-eyed fruit fly.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

2. June/2022/Paper_42/No.1

The jaguar, *Panthera onca*, is a large cat that lives mainly in South America. The majority of jaguars have light brown fur with black spots, as shown in Fig. 1.1. Some jaguars have completely black fur, as shown in Fig. 1.2.

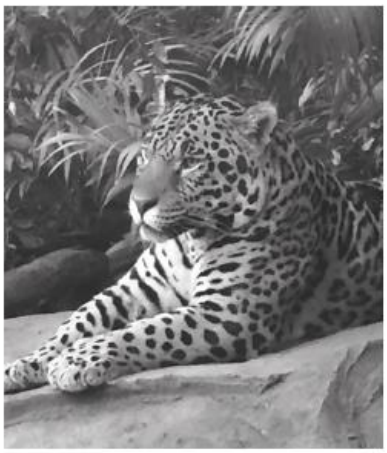

Fig. 1.1

Fig. 1.2

(a) The pigments involved in fur colour are produced as a result of biochemical pathways that take place in cells called melanocytes. These pathways are similar to those that occur in human melanocytes.

The melanocortin 1 receptor (MC1R) is located on the cell surface membrane of melanocytes and is coded for by the *MC1R* gene.

Fig. 1.3 outlines the processes that occur in jaguar melanocytes.

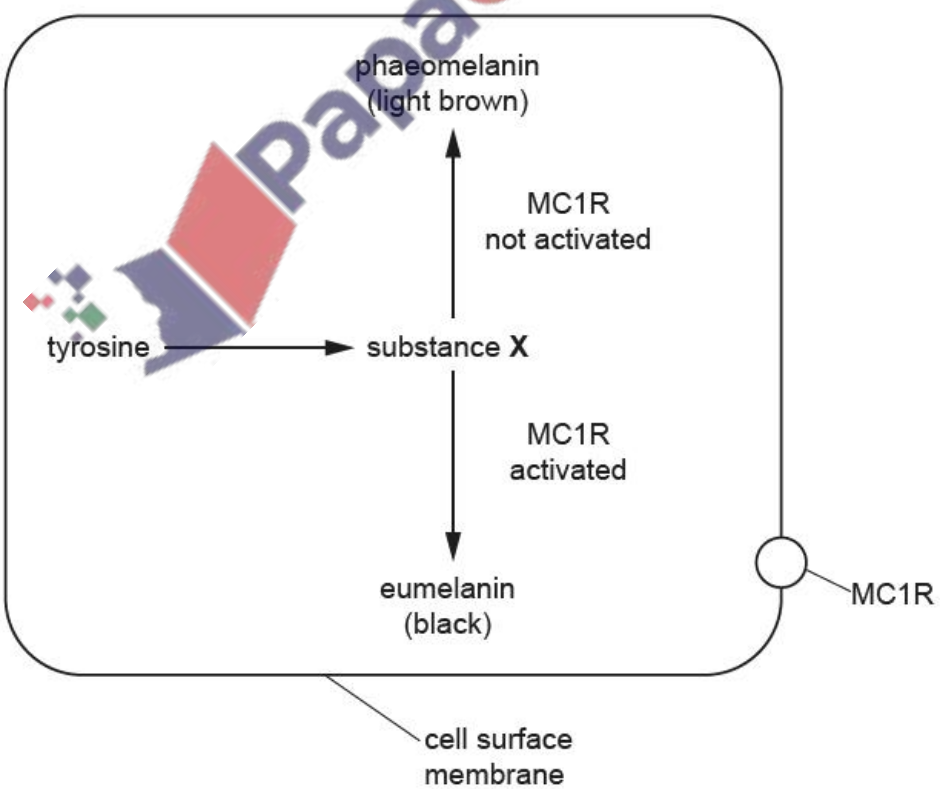

Fig. 1.3

(i) Name the substance represented by **X**.

..... [1]

(ii) When MC1R is activated a second messenger is produced in the cell.

Give an example of a second messenger.

..... [1]

(iii) Substance **X** is also produced in humans, but a mutation of the *TYR* gene can result in substance **X** not being produced.

Describe the phenotype of a person with this mutation.

.....

.....

.....

.....

..... [2]

(b) The *MC1R* gene has two alleles and is located on an autosome.

- When two jaguars with light brown fur mate all the offspring have light brown fur.
- When two jaguars with black fur mate either all the offspring will have black fur or some offspring will have black fur and some will have light brown fur.

Using symbols, construct a genetic diagram to show how two jaguars with black fur can produce some offspring with black fur and some offspring with light brown fur.

[4]

[Total: 8]

3. June/2022/Paper_43/No.7

(a) Epistasis occurs when a gene at one locus can affect the expression of a gene at another locus.

Define the terms gene and locus.

gene .....

.....

locus .....

.....

[2]

(b) Fur colour in mice, *Mus musculus*, is determined by a number of genes. One example is the result of epistatic interaction between two genes, **A** and **B**.

- Allele **A** codes for the production of pigment in the fur.
- Allele **a** does not code for the production of pigment and results in white fur (albino).

- Allele **B** codes for the production of brown fur.
- Allele **b** codes for the production of black fur.

Construct a genetic diagram to show the results, including the ratio, of a cross between two mice heterozygous for both genes.

parent genotypes **AaBb** **x** **AaBb**

parent phenotypes

gametes

ratio..... [6]