

SPCA Auckland Education Teacher Guide Sheet

Cat Colours - Level 6 Science Curriculum

Science in the new Curriculum, Learning Media, Ministry of Education, 1994, p.64 Achievement Objective 6.2 and 6.3

Making Sense of the Living World: ‘Investigate patterns in the inheritance of genetically controlled characteristics and explain the importance of variation within a changing environment’.

Achievement Standard; Science 1.3

‘Describe Aspects of Biology – The transfer of genetic information’.

It is assumed that pupils are familiar with the following terms:

**Gene
Genotype
Phenotype
Homozygous
Heterozygous
Dominant
Recessive
Sex-linked genes**

Resource information courtesy of ‘BIOZONE’

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Cat Colours - Level 7 Biology Curriculum

Biology in the New Zealand Curriculum, Learning Media, Ministry of Education, 1994, p.20 Achievement Objective 7.2

‘Examine scientific evidence for evolution, and explain how genetic variation and natural selection can lead to genetic change within populations’

Achievement Standard: AS90459

‘Describe concepts and processes that relate to genetic variation and change’.

It is assumed that pupils are familiar with the following terms:

Gene
Genotype
Phenotype
Homozygous
Heterozygous
Dominant
Recessive
Multiple alleles
Dihybrid cross
Sex- linked genes

Resource information courtesy of ‘BIOZONE’

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Cat Colours - Level 8 Biology Curriculum

Biology in the NZ Curriculum, Learning Media, Ministry of Education,
1994, p28 Achievement Objective 8.2(a)

'Investigate and describe gene expression'.

Achievement Standard: AS 90715

'Describe gene expression'.

It is assumed that the pupils are familiar with the following:

Gene
Genotype
Phenotype
Homozygous
Heterozygous
Dominant
Recessive
Multiple alleles
Dihybrid cross
Epistasis

Resource information courtesy of 'BIOZONE'

Cat Genetics Worksheet – Level 6 & 7

Background Information - Cats have been domesticated for thousands of years. The original 'wild type' is the shorthaired tabby and all of the present colours have arisen from this. The following picture identifies some of these:



Eyes

May have a range of colouring for the irises; blue, yellow, pink.

Ears

May be normal pointed ears, or the ears may be folded

Coat Colour

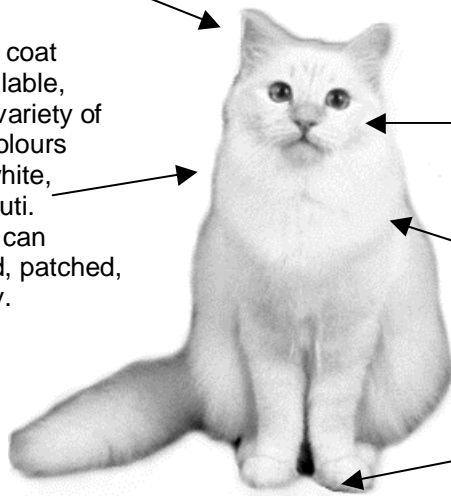
A wide range of coat colours are available, controlled by a variety of genes. Basic colours include black, white, orange and agouti. Colour patterns can range from solid, patched, spotted or tabby.

Coat Length

Hair is usually either long or short. There is a breed with extremely short hair – so much so that it looks hairless (sphinx).

Coat Texture

Smooth hair is the common phenotype, but there is an allele that causes curly hair.



Tail

Most cats have a long tail. An allele for short, stubby tails is almost completely restricted to the bobcat and Manx breeds.

Paws

Most cats have 5 digits on the front paws and 4 on the rear. The occurrence of polydactyly with as many as 6 or 7 digits affects as many as one out of five cats (in some parts of the world it is even higher than this.)

Some of the genes controlling these traits are:

<u>Dominant</u>	<u>Recessive</u>
A - agouti	a - non-agouti
B - black	b - brown
C - unicoloured	cch - silver
	cs - siamese
	ca - albino with blue eyes
	c - albino with pink eyes
D - dense pigment	d - dilute pigment
P - pointed ears	p - folded ears
L - short hair	l - long hair
N - normal tail	n - stumpy/no tail
O - normal colours	o - orange
R - smooth hair	r - curly hair
T - tabby pattern	tb - blotched tabby
G - normal 5 digit toes	g - 6 digits
W - all white, white spots more than half	w - not all white
Ww - white spots, less than half	



A further complication is that some colours are sex-linked -

XoXo orange female

XoY orange male

XbXo tortoiseshell female

Agouti¹ - Dark hairs with a light band of pigment close to the tip.

Silver² - (Chinchilla) looks white, with only the tip shaded.

Pointed³ - Dark extremities e.g. Siamese

Dilute pigment⁴ - makes black cats blue-grey, makes yellow cats cream.

Spottiness (less than half)⁵ - tends to be heterozygous.

Your task is to try and describe the ‘genotypes’ of each cat (up to 10 cats) in the adoption area cattery at the SPCA Auckland Animal Village.

Fill in the following chart as given:



Describe the 'genotypes' of each cat (up to 10 cats) in the Cat Adoption Area, at the SPCA Auckland Animal Village.

Phenotype Record Sheet for Domestic Cats													
Gene	Phenotype	Allele	Sample	Cat 1	Cat 2	Cat 3	Cat 4	Cat 5	Cat 6	Cat 7	Cat 8	Cat 9	Cat 10
Agouti colour	Agouti ¹												
	Non-agouti												
Pigment colour	Black												
	Brown												
Colour present	Unicoloured												
	Silver patches ²												
	Pointed ³												
	Albino with blue eyes												
	Albino with pink eyes												
Pigment density	Dense pigment												
	Dilute pigment ⁴												
Ear shape	Pointed ears												
	Folded ears												
Hairiness	Normal, full coat												
	Hairlessness												
Hair length	Short Hair												
	Long Hair												
Tail length	Normal tail (long)												
	Stubby tail or no tail at all												
Orange colour	Normal colours (non-orange)												
	Orange												
Number of digits	Normal number of toes												
	Polydactylism (extra toes)												
Hair curliness	Normal, smooth hair												
	Curly hair (rex)												
Spottiness	No white spots												
	White spots (less than half) ⁵												
	White spots (more than half)												
Stripes	Mackerel striped (tabby)												
	Blotched stripes												
White coat	Not all white												
	All white coat colour												

Finally, attempt to write each cat's genotype. Use a dash (-) for the second allele for characteristics that could be either *heterozygous* or *homozygous* dominant.



1. aaC-D-P-L-N-ooT-ww

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

Sample cat: To give you an idea of how to read the chart you have created, here is an example genotype for the author's cat with the following features: a smokey grey uniform-coloured cat, with short smooth hair, normal tail and ears with 5 digits on the front paws and 4 on the rear paws, small patches of white on the feet and chest. (Note that the stripe genotype is completely unknown since there is no agouti allele present)

GENOTYPE: aaL-R-N-P-G-Ww