

B14- Variation and Evolution Exam Practice 2

Name:

Score:

Q1.

Variation in individual organisms can be caused by:

- genes
- the environment
- a combination of both genes and the environment.

Figure 1 shows variations in a woman.

Figure 1



(a) What is the cause of each variation in the table below?

Tick only **one** box in each row.

Variation	Cause of variation		
	Genes only	Environment only	Both genes and the environment
Brown eyes			
Light brown skin colour			
Short hair			

(3)

- (b) The allele for blue eyes is recessive (**b**).
 The allele for brown eyes is dominant (**B**).
 A woman has blue eyes.

What are the woman's alleles?

Tick **one** box.

BB **Bb** **bb**

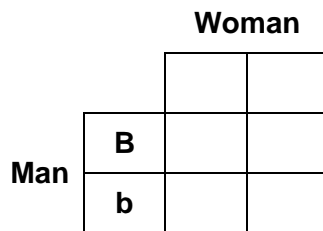
(1)

- (c) The woman marries a man with the alleles **Bb** for eye colour.
 What colour eyes does the man have?

(1)

- (d) Complete the Punnett square diagram in **Figure 2** for this man and woman.

Figure 2



(1)

- (e) What is the probability that a child of this man and woman will have brown eyes?

(1)

- (f) What is the scientific term used for the child's eye colour?

Tick **one** box.

Chromosome

Condition

Genotype

Phenotype

(g) What effect will a mutation have?

Tick **one** box.

Almost certainly have no effect

Definitely change appearance

Definitely be passed on to all children

Probably cause a disease

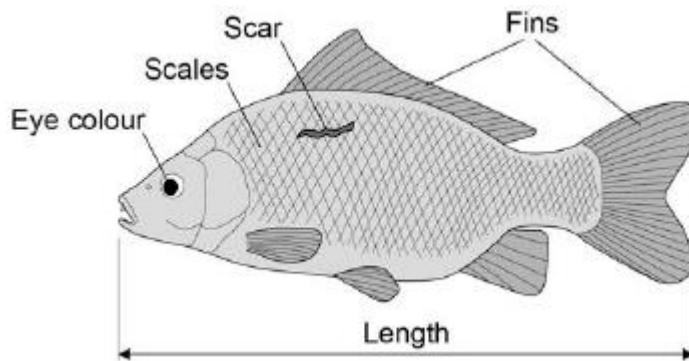
(1)

(Total 9 marks)

Q2.

Figure 1 shows a fish called a carp.

Figure 1



The characteristics of an animal can be a result of:

- only genetic causes
- only environmental causes
- both genetic **and** environmental causes.

(a) Give **one** characteristic shown in **Figure 1** for each different cause.

Only genetic causes _____

Only environmental causes _____

Both genetic **and** environmental causes _____

(3)

(b) Two alleles control the body colour of carp:

- brown (**B**)
- blue (**b**).

The brown allele is dominant to the blue allele.

The genetic cross from breeding two carp is shown in **Figure 2**.

Figure 2

	B	b
b	Bb	
b		

Complete **Figure 2**.

(2)

(c) Draw a ring around **one** blue offspring shown in **Figure 2**.

(1)

(d) What is the probability that the offspring from this genetic cross will be brown?

Tick **two** boxes.

0

0.25

0.5

1.0

(1)

(e) Carp can produce large numbers of offspring.

The two carp crossed in **Figure 2** had 260 000 offspring.

Approximately how many offspring are expected to be brown?

Brown carp offspring = _____

(1)

(f) A pond contains carp used for breeding.

The carp for breeding are brown or blue.

A red carp has been seen.

The red carp was **not** added to the pond.

Suggest what might have caused the red carp to appear.

(1)
(Total 9 marks)

Higher Tier Questions

Q3.

Insulin is now made by a biotechnological process. A description of the process is given below. Complete the gaps in the sentences.

- (a) The first step in the biotechnological process is that a special enzyme is used to cut the insulin _____ out from a human _____ .

In a separate operation, a ring of bacterial _____ is cut open using a special enzyme.

These two pieces of genetic material are combined together to form a new plasmid ring which is inserted into a bacterium.

(3)

- (b) Explain why large quantities of insulin are produced when this bacterium is put into a culture medium.

(2)

- (c) Before insulin was made in this way, it could only be obtained from sheep and pigs. Suggest **two** reasons, other than preventing the exploitation of animals, why it is better to obtain insulin by genetic engineering than from animals.

1. _____

2. _____

(2)

(Total 7 marks)

Q4.

Figure 1 shows one species of bird on a bird feeder.

Figure 1

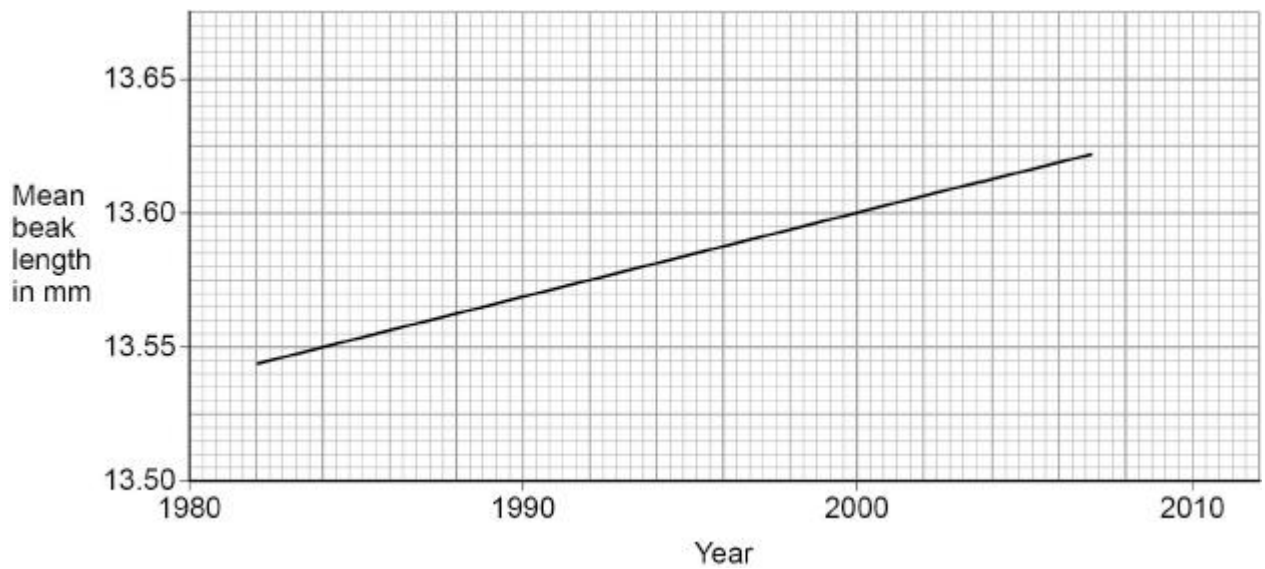


The birds use their beaks to reach nuts inside the bird feeder.

Figure 2 shows the mean beak length of this species of bird in the UK.

This species of bird often visits bird feeders.

Figure 2



(a) Determine the rate of change in beak length from 1984 to 2000.

Use **Figure 2**.

(3)

(d) Birds of this species are found in different parts of the world.

Describe evidence that would show two individual birds are the same species.

(3)

(Total 15 marks)

Mark schemes

Q1.

(a)

	Genes	Environment	Both	
Brown...	✓			1
Light...			✓	1
Short...		✓		1

(b) bb

1

(c) brown

allow light brown or dark brown

1

(d) (using bb for mother's gametes)

correct combination in all four boxes, e.g.

	(b)	(b)
(B)	Bb	Bb
(b)	bb	bb

allow any combination of mother's gametes as mark is for filling in boxes correctly

1

(e) 50%, 0.5, $\frac{1}{2}$

the award of this mark is consequential to the answer in part (d)

ignore ratios

1

(f) phenotype

1

(g) almost certainly have no effect

1

[9]

Q2.

(a) **only genetic causes**
any **one** from:

- pattern of scales
- number of fins
- eye colour

1

only environmental causes:

- scar

1

both genetic and environmental causes:

- length

1

(b)

	B	b
b		bb
b	Bb	bb

allow 2 correct for 1 mark

2

(c) any bb circled

1

(d) 0.5

allow ecf from 04.2

1

(e) (260 000 / 2 =) 130 000

allow ecf from 04.4

1

(f) mutation

allow change in diet / hormones / DNA

1

[9]

Higher Tier Mark Scheme

Q3.

(a) gene or allele

1

chromosome

do not credit cell or pancreatic cell or genome

1

DNA

accept plasmid

1

(b) any **two** from

bacteria grow **or** reproduce

a growth related point

DNA ring **or** plasmid **or** insulin gene
produced each time

a genetic related point

insulin gene (in ring instructs bacteria
to) make insulin

2

(c) any **two** from

same match to human insulin

*accept animal insulin may be rejected **or** may not suit
humans*

no crossing species risk

accept no risk of BSE type species crossing

more easy to obtain **or** can be made in
large quantities

*accept it is cheaper to make in the long term **or** it's quicker
do not credit it's cheap*

an ethical answer such as no religious
or cultural concerns

*accept it is cheaper so can be made available to many more
people*

2

[7]

Q4.

(a) 13.55 (mm) **and** 13.60 (mm)

1

$$\frac{13.60 \text{ (mm)} - 13.55 \text{ (mm)}}{2000 - 1984}$$

allow

0.05

16

allow correct working from other pairs of readings

1

0.003125 (mm/year)

or

3.125×10^{-3} (mm/year)

allow correct answer from other pairs of readings

*allow a correct answer given to any number of
significant figures*

1

(b) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and
logically linked to form a clear account.

5-6

Level 2: Relevant points (reasons / causes) are identified, and there are

attempts at logical linking. The resulting account is not fully clear. 3-4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. 1-2

No relevant content 0

Indicative content

- there is variation in beak length (in this bird population)
- variation is due to mutations
- beak length is controlled by gene(s)
- birds with longer beaks can reach more nuts / food **or** birds with longer beaks can fight with **or** outcompete birds with shorter beaks
- therefore have more energy from food
- so can produce more offspring **or** reproduce more
- those offspring that inherit the long beak allele more likely to survive
- which is natural selection
- pass allele / gene (for long beak) on
- repeated over many generations
- birds are evolving to have longer beaks

For **Level 3** detail of process of evolution must be linked to beak length **and** implication of several generations is required.

- (c) shorter life cycle / span 1
- allow converse if clearly referring to human evolution*
- ignore shorter life*
- more offspring 1
- (so) the genetics of the population changes faster 1
- allow effect of mutations seen sooner / faster **or** humans can see evolution in birds during the course of a human life(time)*
- allow more fossil evidence*
- (d) similar / same phenotype 1
- similar genotype / DNA (profile) 1
- (can reproduce / breed and) produce fertile offspring 1

[15]