

B13- Reproduction Exam Practice 1

Name:

Score:

Q1.

A human body cell contains 46 chromosomes.

- (a) How many chromosomes does a human sperm cell contain?

Tick (✓) **one** box.

22 23 46

(1)

- (b) Draw **one** line from each word to the meaning of that word.

Word	Meaning
<input type="text" value="Gene"/>	<input type="text" value="A small ring of DNA in the cytoplasm"/>
<input type="text" value="Genome"/>	<input type="text" value="All the genetic material of an organism"/>
<input type="text" value="Nucleus"/>	<input type="text" value="A small section of DNA which codes for a protein"/>
	<input type="text" value="A structure which contains chromosomes"/>

(3)

Some plants contain a harmful chemical called PTC.

Some people can taste PTC.

- (c) Suggest **one** advantage of being able to taste PTC.

(1)

Only people with a dominant allele **T** can taste PTC.

People with **only** the allele **t** cannot taste PTC.

(d) A person has the genotype **Tt**.

What word describes the person's genotype?

Tick (✓) **one** box.

Heterozygous

Phenotype

Recessive

(1)

(e) Give the genotype of a person who **cannot** taste PTC.

(1)

(f) A woman and a man plan to have a child.

The woman and the man both have the genotype **Tt**.

Complete the figure below to show the possible genotypes of the child.

		Woman	
		T	t
Man	T	TT	
	t		

(2)

(g) What is the chance of the child being able to taste PTC?

Use the figure above.

Tick (✓) **one** box.

25% 50% 75% 100%

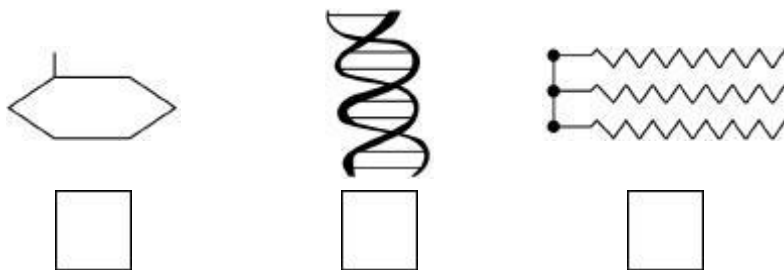
(1)
(Total 10 marks)

Q2.

This question is about DNA and genes.

(a) Which diagram represents a DNA molecule?

Tick (✓) **one** box.



(1)

(b) Describe the structure of a DNA molecule.

(1)

(c) A gene is a small section of DNA on a chromosome.

Complete the sentences.

A gene codes for a particular sequence of _____.

This sequence makes a specific _____.

(2)

(d) What is meant by the term genome?

(1)

(e) The complete human genome is now known.

Which important scientific advance was made using knowledge of the human genome?

Tick (✓) **one** box.

Discovering antibiotic resistant bacteria

Finding more foods to eat from tropical forests

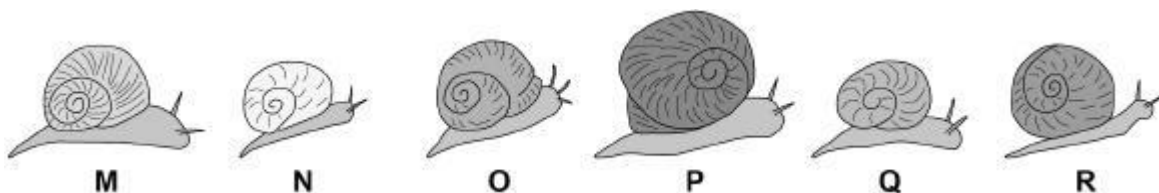
Tracing how aboriginal people spread across Australia

Working out when the last ice age ended

(1)

A student found six different snails of one species in his garden.

The diagram below shows the snails.



(f) All the snails are different.

What scientific term describes differences in characteristics between individuals of a species?

(1)

(g) A change in DNA has caused snail **P** to be very different from the other five snails.

Suggest why there might be an increasing number of snails similar to snail **P** in each future generation.

(2)

(Total 9 marks)

Higher Tier Questions

Q3.

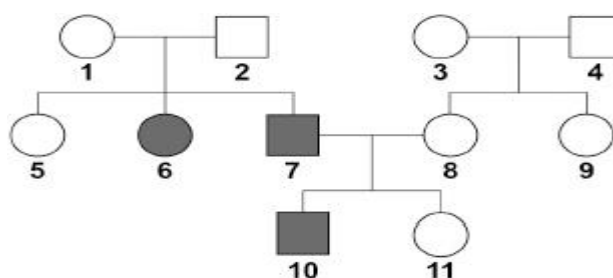
This question is about genetic disorders.

- (a) Some people are heterozygous for a genetic disorder.





Define the term 'heterozygous'.

(1)

- (b) The figure below shows the inheritance of a genetic disorder in a family.



Key

-  Female who does **not** have the disorder
-  Male who does **not** have the disorder
-  Female who has the disorder
-  Male who has the disorder

Person **7** and person **8** plan to have another child.

Determine the probability that the child will be a **male** who has the disorder.

You should:

- draw a Punnett square diagram
- identify the genotype of person **7** and the genotype of person **8**
- identify the phenotype of each offspring genotype
- use the symbols:
H = dominant allele
h = recessive allele

(b) The couple want to have a child.

Use a Punnett square to determine the probability of the child having Huntington's disease.

Circle the genotypes of any children that will have Huntington's disease.

Probability of child having Huntington's disease = _____

(4)

(c) The couple visit a genetic counsellor, who gives them the following options.

1. Adopt a child.
2. Gamete donation – uses sperm from another man to fertilise the woman's eggs by in vitro fertilisation (IVF).
3. Conceive naturally.
4. Use pre-implantation genetic diagnosis (PGD).
 - Many embryos are produced by IVF using gametes from the man and woman.
 - Embryos are tested for Huntington's disease and a healthy embryo is implanted into the woman's uterus.
 - The risk of implanting an embryo with the allele for Huntington's disease is 0.2%.
 - Costs the NHS about £11 000.
5. Conceive naturally and use prenatal diagnosis (PND) once the woman becomes pregnant.
 - A sample of the placenta is taken at 10 weeks of pregnancy or a sample of fluid is taken from around the developing baby at 16 weeks of pregnancy.
 - The sample is tested for the Huntington's allele.
 - A 0.5–1.0% risk of miscarriage.
 - About 1% of samples collected are unsuitable for testing.
 - Costs the NHS about £600.

The couple decide they want to have a healthy baby that is their own biological offspring.

Evaluate the options.

Suggest which option would be best for the couple.

(6)
(Total 11 marks)

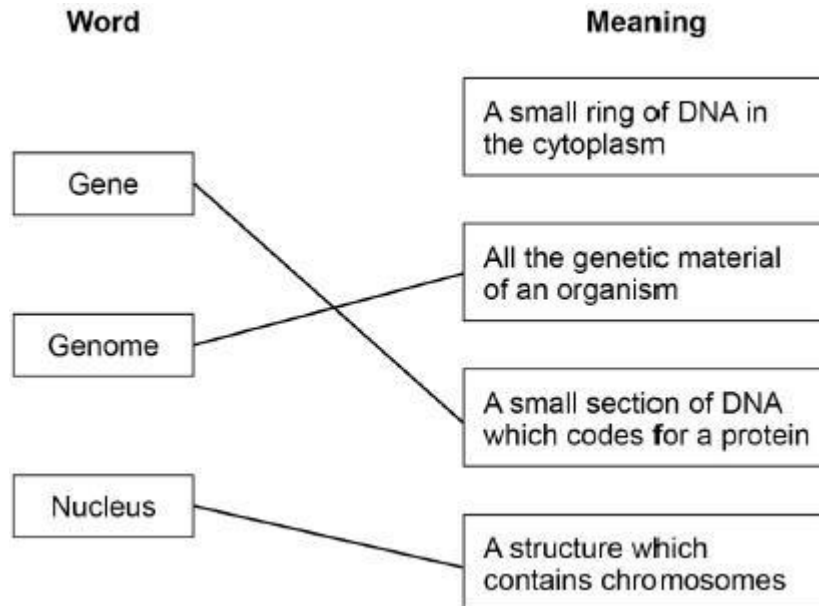
Mark schemes

Q1.

(a) 23

1

(b)



additional line from a box on the left negates the mark for that box

1
1
1

(c) any **one** from:

- to survive
allow to protect them
- so you do not eat the plants
- to stop you being harmed / poisoned
allow stop you getting ill / dying

1

(d) heterozygous

1

(e) tt

allow homozygous recessive

1

(f)

		Woman	
		T	t
Man	T	TT	Tt
	t	Tt	tt

allow 1 or 2 genotypes correct for 1 mark

2

(g) 75%

allow **only** a probability consistent with student's derivation

if no answer to question (f)

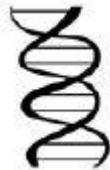
allow 75%

1

[10]

Q2.

(a)



1

(b) any **one** from:

- 2 strands / chains that are twisted / coiled / spiralled

allow cross links between 2 strands / chains

- double helix
- (long) polymer

allow reference to nucleotides or sugars, phosphates and bases

1

(c)

in this order only

amino acids

1

protein

allow polypeptide

1

(d) all the genetic material (of an organism)

allow DNA / genes for genetic material

ignore chromosomes

1

- (e) tracing how aboriginal people spread across Australia 1
- (f) variation
ignore genetic/environmental 1
- (g) stronger / larger (shell) 1
- (so) more likely to (survive and) breed
or
(so) more likely to (survive and) pass on genes
- OR**
- (better) camouflaged (1)
- (so) less likely to be eaten and will breed more (1) 1

[9]

Higher Tier Mark Scheme

Q3.

- (a) any **one** from:
- (having two) different alleles for a gene / trait / characteristic / disorder
ignore examples such as Hh
ignore having two different alleles unqualified
 - (having) the dominant **and** recessive allele for a gene / trait / characteristic / disorder
- 1
- (b) father / person 7 **hh** 1
- mother / person 8 **Hh**
- allow **hh** and **Hh** parental genotypes with each parent unidentified **or** reversed for 1 mark*
- 1
- (possible offspring correctly derived)
hh (× 2)
Hh (× 2)
- allow correctly derived offspring from incorrect parental genotype(s)*
- 1
- (each different phenotype identified)
hh = has the disorder
Hh = does not have the disorder
- allow from incorrectly derived offspring
if incorrectly have **HH** = does not have the disorder*
- 1

0.5

*allow 50% or ½ or 1:1 or
1 out of 2 or 1 in 2
do not accept 1:2
allow probability of having disorder correctly
derived from incorrect parental genotypes*

1

(probability of male with disorder)

0.25

*allow 25% or ¼ or 1:3 or
1 out of 4 or 1 in 4
do not accept 1:4
allow probability of male with disorder correctly
derived from incorrect probability of having the
disorder*

1

(c) caused by mutation

*allow description, for example change in the
genetic code or change in base sequence*

1

during meiosis

*allow in (germ) cells prior to meiosis
allow in (the formation of) gametes / egg / sperm
allow during mitosis between fertilisation and
birth*

1

causing a change in amino acid sequence

1

causing a different (specific) protein to be produced

or

causing none of a (specific) protein to be produced

*causing a different (specific) enzyme to be
produced*

or

*causing none of a (specific) enzyme to be
produced*

*allow polydactyly is caused by a dominant allele
so if child has one / the allele (with the mutation)
they will have the disorder*

*if no other mark awarded allow parents used
donated egg / sperm for 1 mark*

1

[11]

Q4.

(a) Man's genotype **Hh**

both needed for the mark

Woman's genotype **hh**

1

(b) gametes correctly derived from parents genotypes in 05.1

1

offspring genotypes correctly derived from gametes

1

all Hh circled

Man's gametes		Woman's gametes	
		h	h
	H	Hh	Hh
	h	hh	hh

1

(Probability =) any **one** from:

- 50%
- $\frac{1}{2}$
- $\frac{2}{4}$
- 0.5
- 1 in 2
- 2 in 4
- 1:1
- 2:2

1

(c) **Level 3 (5–6 marks):**

A detailed and coherent evaluation is provided which considers a range of relevant points and comes to a conclusion consistent with the reasoning.

Level 2 (3–4 marks):

An attempt is made to relate relevant points and come to a conclusion. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):

Discrete relevant points made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.

0 marks:

No relevant content

Indicative content

- adoption / gamete donation unsuitable as offspring not biologically theirs
- natural conception too risky / only 50% chance of healthy offspring
- natural conception would cause worry whether baby would be healthy or not
- (therefore) choice is between PGD and PND

pros of PGD

- baby would be theirs
- results obtained at an early stage
- high chance baby produced would be healthy

- parents would have confidence of having a healthy baby from start of pregnancy
- lower risk of miscarriage compared to PND
- frozen embryos can be used to have another healthy child
- PGD occurs before pregnancy / implantation
- PGD does not involve abortion so less trauma / less pain / ethical comparison
- spare healthy embryos may be used for research / medical treatment

cons of PGD

- slight / 0.2% chance of misdiagnosed embryo
- expensive procedure
- cost to NHS of non-essential procedure
- (unhealthy) embryos might be destroyed
- large number of embryos produced so healthy embryos may be destroyed
- ethical issues of using embryos for research
- some people are opposed to IVF due to their religious beliefs

pros of PND

- natural conception less invasive for mother
- psychological benefit of producing child naturally
- 99% / high chance that result of test will be conclusive

cons of PND

- sampling technique invasive to mother
- risk of miscarriage
- risk of infection
- long wait before test can be carried out
- 50% chance baby will have allele for Huntington's disease
- parents will have a difficult decision to make if baby is unhealthy
- baby may be aborted
- ethical / religious issues of abortion
- a justified conclusion