

**Model Answers: Easy**

1a

(a) Genetic engineering can assist farmers in meeting the world's food demands as follows...

Any **two** of the following:

- Increased yield / a higher yield in a shorter time (of meat or crops); [1 mark]
- Example of a feature that leads to increased yield, e.g. frost / drought resistant crops OR disease / pest / herbicide resistant crops; [1 mark]
- Increased nutrient/vitamin content (of meat/crops) / named example of increased nutrient content; [1 mark]

*Accept other specific examples that relate to increasing the quantity or quality of food production.*

**[Total: 2 marks]**

This is a specific learning point from your specification, so make sure that you can explain the benefits of genetic engineering in relation to meeting the global demand for food.

1b

(b) Three social and/or ethical implications of using GMOs in food production are...

*Negative implications*

- A lack of long term research on the effects on human health; [1 mark]
- Reduction in biodiversity (due to only growing a few GM varieties of crops); [1 mark]
- Consequences occur without consent e.g. pollen from GM crops contaminate nearby non-GM crops that have been certified as organic; [1 mark]
- GM crops may become weeds or invade the natural habitats bordering the farmland; [1 mark]
- GM crops may have non-target effects / named non-target effect, e.g. killing insects that are not pests/pollinators; [1 mark]
- GM crop seeds are expensive / only affordable for some farmers / need to be repurchased every year; [1 mark]

*positive implications*

- Many with nutrient deficiencies can be helped by enriched foods; [1 mark]
- Reduced impact on the environment due to there being less need to spray pesticides; [1 mark]

**[Total: 3 marks]**

1c

(c) Non-labelling of genetically modified food is a concern for some people because...

Any **one** of the following:

- Some people may not want to eat genetically engineered food; [1 mark]
- People cannot make informed decisions (if the food is not labelled); [1 mark]
- People will not be able to monitor whether they are eating genetically engineered food; [1 mark]

**[Total: 1 mark]**

This is a **suggest** question, meaning that you need to do some reasoning to work out the answer. A lot of ethics is about the rights of an individual to choose what they want to do, so here the concern is that if people don't know what they are buying, they do not truly have a choice.

2a

(a) (i) Salmon have been altered using genetic engineering as follows...

- To produce growth hormone throughout the year / all year (instead of in spring and summer only); [1 mark]

(a) (ii) This is beneficial to salmon farmers because...

- The salmon grow all year **SO** are ready to be sold much more quickly / in half the time; [1 mark]

This is an **explain** question so you need to state **why** this change is useful to farmers.

**[Total: 2 marks]**

2b

(b) Salmon farmers ensure that the new gene inserted into the GM salmon does not enter wild salmon populations by...

Any **one** of the following:

- Only farming sterile females; [1 mark]
- Keep fish in controlled environments / (sea water) cages; [1 mark]

**[Total: 1 mark]**

2c

(c) A conclusion from the data in Table 1 is..

- There is an increase in growth/mass of genetically engineered salmon compared to non-engineered salmon **OR** genetically engineered salmon have a greater/larger mean mass than non-genetically engineered; [1 mark]

**[Total: 1 mark]**

Don't be put off by the novel context or the large amount of 'blurb' that is often presented to you in data analysis questions. Keep focused on what the question is asking of you; here you are writing a simple conclusion and no explanation is needed.

Be careful when drawing conclusions from single data sets like this; you should always stick to what you can say from the data alone. E.g. you should generally avoid stating that one factor has *caused* a change in the other.

2d

(d) A feature of the design of the investigation that helped to ensure the validity of the experiment is...

Any **one** of the following:

- Large sample size **SO** it is representative of the salmon population; [1 mark]
- Carried out over 12 months **SO** there is enough time for the salmon to grow **OR** 12 months is enough time to assess growth; [1 mark]
- A control group / non-engineered salmon were included **SO** comparisons can be made / any difference will be due to the *GH* gene; [1 mark]

**[Total: 1 mark]**

The **validity** of an investigation is about whether it truly **measures what it set out to measure**. Aspects of design that will increase validity include ensuring that a sample size is **representative** of the population of interest, controlling additional **variables**, and the inclusion of an **experimental control**.

The command word here is **explain** so you need to make sure you express **why** the identified feature made the experiment more valid.

3a

(a) The effect this gene modification has on these cotton plants is...

- Plants modified with the Bt toxin gene produce an insecticide / a chemical that is toxic to insects; [1 mark]

**[Total: 1 mark]**

3b

(b) Resistance, in the context of cotton plants and the Bt toxin, means...

Any **two** of the following:

- Insects with the allele for Bt resistance are more likely to survive and reproduce / the Bt toxin acts as a selection pressure / alleles for Bt toxin resistance become more common in the insect population; [1 mark]
- Insects are no longer affected/killed by the Bt toxin; [1 mark]
- (Resistant) insects will continue to damage/eat cotton plants **OR** cotton plant yields may be reduced/affected by insect pests; [1 mark]

**[Total: 2 marks]**

Over time, insect populations have developed **resistance** to the genes for Bt toxin, reducing its effectiveness as a means of protecting crops.

This is very similar in mechanism to the way in which bacteria become resistant to antibiotics.

3c

(c) The scientists concluded that the presence of the resistance gene protects plants against glyphosate herbicide because...

- The SD bars do not overlap; [1 mark]
- The difference between the data sets is significantly different; [1 mark]

**[Total: 2 marks]**

The question asks you to specifically comment on **the data**, so you should be looking at all the information provided.

Note that the SD bars would not have been included if the examiners didn't want you to comment on them!

Be careful with your language when you are describing statistical significance; you must NEVER state that 'the data is significant', but should instead always say that 'the **difference** between the data sets is significant'.

3d

(d) The effect of the herbicide resistance gene on soybean plants can be explained as follows...

Any **two** of the following:

- Soybean plants with the resistance gene can produce an enzyme which allows the synthesis of amino acids / proteins required for growth; [1 mark]
- In plants without the resistant gene the herbicide/glyphosate inhibits the enzyme so the plants die/cannot grow; [1 mark]
- Weeds/plants that compete with the soybeans (for light, water and minerals) are killed; [1 mark]
- Soybean plants that have no competition can grow faster (so increasing the yield); [1 mark]

**[Total: 2 marks]**

