

Threatened bananas

1 (2p) The answer must show that

- an equal distribution of (homologous) chromosomes is not possible / the meiosis does happen normally 1
- (as a result) no correct (haploid) gametes will be formed (from which seeds will develop after fertilization) 1

2 (2p) The answer must show that

- the fungus (hyphae) may already be in the side buds / the spores may be present in the (adhering) soil around the buds 1
- when planting (from those side buds) in the soil in a new place the fungus is introduced there 1

Note: For a response to the effect that the buds are clones and therefore all equally susceptible to the disease, no points are awarded.

3 (1p) The answer must show that the modification is cisgenic, because it involves a transfer of genes of the same species.

4 (1p) examples of a correct advantage of genetic modification:

- work is focused on one (desired) genetic trait.
- no desired properties are lost.
- no unwanted genes are bred in.

5 (2p) The answer must show that due to blockage of the xylem

- the water supply (to the leaves) is impeded / water shortage occurs 1
- (with the result that) the stomata close and (due to a lack of CO₂) reduce photosynthesis (which can cause the plant to die) 1

Note: For the answer that the leaves die causing photosynthesis to stop, 1 point is given.

6 (2p) A

7 (3p) examples of a correct method with result and correct conclusion:

- On one group of the banana plants on the plantation, the young inflorescences are covered with dark cloths so that the sunlight can only be added (indirectly) from below. If the fruits covered by these cloths grow upwards just like the uncovered fruits on the plantation, the curvature is not affected by the light.
- In a darkened greenhouse, ensure that the flowers are only illuminated from the side by lamps in one part of the banana plants, and only from above in another part (the control group). If the side-lit bananas grow less upwards than the control bananas, there is influence of light on the curvature.

- for effective manipulation of light 1
- for the use of several groups of plants including a suitable control situation
1
- for a correct combination of a possible result and conclusive 1

8 (2p) D

9 (2p) examples of a correct answer:

- many fungi are decomposers that recycle dead material. If these decomposers are also killed, fewer nutrients become available for the plants.
- fungi that live in symbiosis with plants are also affected, so that less nitrogen fixation takes place.
- there are fungi that make antibiotics against bacteria. If those fungi are also inhibited, more infections of plants with soil bacteria can occur.
- you do not want to kill useful fungi that help the roots absorb nutrients, otherwise the harvest will decrease.

- delayed production only inhibits Fusarium / does not inhibit other fungi 1
- with a description of the usefulness of other fungi or the damage caused by the absence of other fungi for the ecosystem 1

Note: No point is given for the answer that (certain) fungi could become resistant.

10 (2p) B

Bone determines fertility

11 (2p) The answer must show that

- spermatogonia are the (stem) cells from which sperm cells have to be formed for many years 1
- after mitotic division, one of the two daughter cells functions as a stem cell / these cells would be used up by meiotic divisions 1

12 (2p) example of a correct answer:

Because FSH release is inhibited, Sertoli cells produce less ABP. As a result, less testosterone is transported to the lumen, resulting in less spermatogenesis (and therefore infertility).

- for a correct relationship between FSH inhibition and ABP production (via LH / ICSH) by cells from Sertoli 1
- transport of testosterone (bound to ABP) to lumen is necessary for spermatogenesis (and therefore for fertility) 1

13 (2p) C

14 (2p) B

Testing for sickle cell disease

15 (1p) The answer must show that in the pedigree there are daughters with sickle cell disease while the father / while the parents do not have the disease (or a specific example of such a situation: with daughters II-5, II-7 or IV -5).

16 (2p) D

17 (2p)

- there must be sufficient DNA available for visible fragments (as bands) after electrophoresis 1
- PCR (method) / polymerase chain reaction / polymerase chain reaction 1

18 (2p) example of a correct drawing:

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5' GTG CAC CTG ACT CCT GAG GAG 3'
3' CAC GTG GAC TGA GGA CTC CTC 5'
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- the complementary strand is correctly added (if the order of the example in figure 3 is followed, the 5 'and 3' side do not have to be indicated) 1
- the cutting location indicated correctly 1

19 (2p) A

HPV vaccination

20 (2p) C

21 (2p) A

22 (2p)

- no: boys (due to an HPV infection) have no risk of getting cervical cancer 1
- yes: boys can become carriers of the HPV and then (in case of sexual activity) infect a girl 1

23 (2p)

- under the influence of the virus protein E6 / due to inhibition of tumor suppressor genes, the cell cycle is not stopped / not properly checked in the event of DNA damage / apoptosis does not occur in the event of DNA damage resulting in unrestricted divisions of these (abnormal) cells / the development of a cancerous tumor / accumulation of oncogenes 1
- examples of a correct statement 1
 - More damage to the DNA occurred later in life.
 - As you get older, the expression of tumor suppressor genes will decrease.
 - The immune system is less effective in old age.

24(2p) B

Heart surgery

25 (3p) The answer must show that

- the coronary artery is narrowed / roughened / less elastic due to atherosclerosis
1
- a thrombus can develop in the event of a thrombosis / an embolus can get stuck / a (blood) plug may disrupt circulation 1
- due to which there is insufficient supply of (oxygen-rich) blood in the heart muscle (with the possible consequence of a heart attack) 1

26 (1p) examples of a correct benefit:

- an artery is more elastic / muscular
- an artery is more suitable for processing the arterial pressure

27 (2p) C

28 (2p) E

29 (2p)

- Heparin is needed to ensure that the coagulation reaction (after cutting the blood vessel) is not activated 1
- Protamine is needed to regain normal coagulation after the operation
1

Laughing muscles

30 (2p) C

31 (1p) examples of a correct conclusion:

- Positive verbs have a stronger effect on laughter muscles than positive adjectives.
- The maximum smile position is reached after approximately 1.75 seconds.
- It takes more than 0.5 seconds for a reaction in the cheekbone muscles to be measured.

Note: For the conclusion 'the longer you see the positive word, the greater the response' or 'the response to positive words is opposite to that to negative words' no points are awarded.

32 (2p) B

33 (2p) B

34 (2p) D

35 (2p)

- (impulses originate) in the motor cortex / in motor centers (of the face) / in the frontal lobe 1
- (impulses end) in the sensory cortex / in (primary and secondary) sensory centers / in the parietal lobe 1

Fertilizers and bacteria

36 (2p) The answer must show that

- NADH dehydrogenase causes H^+ to move, creating a gradient (across the inner membrane) 1
- which is used to make ATP using ATP synthase (from ADP + Pi) 1

37 (2p) B

38 (2p)

- rhizobium bacteria convert nitrogen / N_2 (from the air) into NH_3 / ammonium / NH_4^+ 1
- which the (leguminous) plant absorbs / which the plant uses for protein synthesis / which partially ends up in the soil (& after plowing, this is converted by decomposers into nitrogen containing compounds that can be taken up by other plants / nitrate) 1

39 (1p) examples of a correct answer:

- because the conversion (from N_2 to ammonium and nitrate) through rhizobium bacteria is gradual, there is less risk of leaching of fertilizers
- the production and distribution of fertilizer costs more energy than the use of green manure
- there is less chance of over-fertilization, which can cause eutrophication of surface water.