19. Genetic Technology

19.3 Genetically Modified Organisms in Agriculture

Paper 4

Marking Scheme

Q1.

(b)	*any **two** from:* 1 high / increase in, yield / productivity / quality **or** more food ; 2 increased income / reduce costs ; 3 can use herbicides / AW ; 4 less / no, competition ; 5 no need to plough / less labour intensive ;	**2**

Q2.

(b)	*any **three** from:* 1 to, store / contain, multiple / many, genome / DNA / nucleotide, sequences ; 2 to, align / compare / search, sequences ; 3 to, process / analyse / sort / calculate from, large quantities of data ; 4 to, share / access, data / information from, others / elsewhere ; 5 to save time / fast(er) ;	**3**

Q3.

(a)(i)	1 DNA, joined / combined / made, from two / different, sources / species ; 2 using (named), enzymes / vectors **or** to create a, GMO / transgenic organism ;	**2**
(a)(ii)	to, test / compare, effect(iveness) of, genes / proteins / Bt and OCII / plants / varieties / **A** and **B** **or** to see which, (gene / plant / variety / of **A** and **B**), works, better / best ;	**1**
(a)(iii)	to compare / provide a baseline / as a control ;	**1**

(b)	1 **A** and **B** kill larvae ; 2 GM increases, yield of / food from (potatoes) ; 3 **A**, is best / kills most / works faster / should be grown / will provide most food ;	**3**

Q4.

(b)(ii)	*any* ***three*** *from:* **1** more food / increase yield / help solve global demand for food ; **2** improves quality of, fruit / oranges / crop ; **3** more income for, growers / farmers ; **4** cheaper / lower cost, fruit / oranges / food (to consumer) ; **5** spend less on / use less / no need for, (bactericidal) chemicals / pesticides ;	**3**

Q5.

(b)(i)	**C** ;	**1**

(b)(ii)	*any* ***three*** *from:* 1 increased / high, (crop) yield ; 2 *idea of* less food shortages / more food production / helps solve global demand for food ; 3 less need to remove weeds (by hand) ; 4 more income for, growers / farmers **or** *ref. to* economic benefit for, country / region ; 5 cheaper / lower cost, to buy ; 6 AVP ; e.g. less need for deforestation of other land	**3**

Q6.

(b)(i) — **4**

*any **four** from:*

valid

1 GM spinach decreases number of, bacteria / *E.coli*
or
GM spinach has lowest number of, bacteria / *E.coli* ;

2 at all times (meat is stored)
or
the longer the time stored the more effective it is
or
most effective after 72 hours ;

3 data quote comparing no treatment or buffer alone with GM spinach extract at stated time ;

time / hrs	no treatment	buffer alone	buffer plus GM spinach
1	3.7–3.8	3.8–3.9	1.4–1.5
24	3.2–3.3	3.5–3.6	0.5–0.6
72	2.6–2.7	3.3–3.4	0.1–0.2

not valid

4 no treatment / buffer alone, (also) decrease number of, bacteria / *E.coli*
or
GM spinach does not kill **all**, bacteria / *E.coli* ;

5 meat should not normally be left at 10°C
or
people unlikely to eat meat left at, 10°C / for 72 hours ;

6 does not test effect on people / AW ;

(b)(ii) — **3**

*any **three** from:*

1 may alter, taste / texture / quality, of meat ;

2 may be unsafe for humans / allergies / side effects ;

3 may harm, gut / beneficial, bacteria
or
may increase growth of, non-colicin sensitive / other, bacteria ;

4 contaminate food labelled as organic / AW ;

5 *E.coli* / bacteria, may develop resistance to, (spray / colicins) ;
R GM spray / colicins, cause mutation

6 AVP ; e.g. may decrease food hygiene practices in, meat factories / abattoirs / restaurants / food outlets ;

Q7.

(b)(i)	*any **three** from:* **1** increased / higher / more, yield / production / harvest / food ; **2** increased / higher / better, quality of, produce / crops / food ; **3** decreased / lower / less, insecticide / pesticide, needed / used ; **4** decreased / lower / less, fuel use / CO_2 emissions ; **5** potential for, set-aside / conservation areas (as less land needed for crops) ; **6** (described) comparative economic benefit ;	**3**
(b)(ii)	*any **two** from:* **1** people in other (named) continents eat GM, food / crops ; **2** GM, food / crops, already in (European) food chain ; **3** *ref. to* economic benefit of reducing GM (animal food) imports ;	**2**
(b)(iii)	**1** do not know / need to know, total crop area / non-GM crop area ; **2** so can work out, percentage / fraction, of, GM / non-GM ;	**2**

Q8.

(b)(i)	*any **two** from:* 1 gourds might become invasive ; 2 more competition from gourds might reduce food production ; 3 might harm gourd genetic diversity ; 4 resistant gourds might have, unknown / adverse, effects on ecosystem ;	**2**

(b)(ii)	*any **two** from:* 1 resistance gene makes hybrids more susceptible to *Erwinia* ; 2 gene flow less of a problem than predicted (for this GMO) ; 3 GM squashes are 'safe' to grow ; 4 AVP ; e.g. could still be a problem in areas lacking, beetle / *Erwinia*	**2**
(b)(iii)	insecticides used to, kill beetle <u>vector</u> / prevent beetles spreading *Erwinia* **or** beetles may only feed on hybrids ;	**1**

Q9.

(c)	*any **two** from:* 1 take, gene / (c)DNA, for <u>rubisco activase</u> ; 2 from, <u>cotton</u> and insert into, (false) flax / (named crop) plant / embryo ; 3 to maintain rubisco action at, high temperatures / >37.5 °C / up to 42.5 °C ; 4 AVP ;	**2**

Q10.

(b)(ii)	*advantage:* improved yield / plants do not die of disease / crop not lost ; *disadvantage:* viral proteins might cause allergies / may be social resistance to GM crops ;	**2**

Q11.

(d)	*any **one** advantage:* **1** stops / reduces, diarrhoea (in children) ; **2** improves children's, nutrition / growth / development ; *any **one** disadvantage:* **3** safety risks unknown / potential allergen / side effects ; **4** may disrupt ('good') bacteria / AW ; **5** expensive ; **6** not willing to drink GM milk ;	**2**

Q12.

(b)	1 decrease / ban / 0%, GM soybean (cultivation), decreases yield ; 2 use GM soybean, more / 94%, increases yield ; *use GM crops – accept **ora** throughout if GM crops banned* 3 increase food supply / decrease food cost ; 4 relieve, hunger / starvation ; 5 less / more, herbicides used ; *correct context needed* 6 less / more, money spent on herbicides ; *correct context needed* 7 increase profits / improve economy ; 8 unknown health consequences ; (can be positive or negative) 9 high cost of GM seed ; 10 *idea of* decrease in, genetic variation / biodiversity ;	**5**

Q13.

(b)	*any **four** from:* *description (D), social (S), ethical (E)* **D1** ban / 0%, GM maize, decreases, yield / harvest ; **D2** (grow) more / 88%, GM maize , increases, yield / harvest ; **S1** GM crops increase food supply ; **S2** GM crops decrease food cost ; **S3** GM crops increase a country's wealth ; **E1** GM crops relieve, hunger / starvation ; **E2** GM crops reduce land area for crops so, conserve habitats / protect biodiversity / allow biofuel cultivation ; 8 less insecticides could be used (in Argentina / Honduras / Spain) ; 9 negative, social / ethical, implication **from data** ;	**4**

Q14.

(a)(i)	*any two from: (transgenic pigs – **ora** for normal pigs)* 1 GH (concentration) higher / GH always present not just at certain times ; 2 hGH, works for longer / broken down less quickly (than pig GH) ; 3 increase in cell signalling ; 4 increased / activates, (growth) gene, expression / transcription ; 5 increased / stimulates, cell division / mitosis ; 6 (make) more, muscle / bone / fat ;	**2**
(a)(ii)	*any three from:* 1 (mouse DNA / it) **is,** the <u>promoter</u> ; 2 (where) RNA polymerase / transcription factor(s), bind ; 3 controls / allows / ensures / is needed for, gene expression / gene activation / mRNA production / hGH production ; 4 gene can be, switched on / transcribed, by adding metal ions ; 5 *idea of* controlling, when / where / how much, the gene is, expressed / transcribed ;	**3**
(b)(i)	*NO arguments (any two to question max three):* 1 few offspring / don't pass on gene(s) / unsustainable / assisted reproduction is expensive (as problem with mating) ; 2 cost of healthcare / less growth / die young (due to ulcers) ; 3 people may, avoid / refuse to buy / pay less for, GM food ; 4 (GM) production cost, expensive / outweighs benefits (as 1% success) ; *YES arguments (any two to question max three):* 1 greater yield / more meat (as higher, body mass / muscle) ; 2 higher price / worth more money, as more muscle to fat ; 3 sell / slaughter / process, earlier / at younger age ;	**3**

(b)(ii)	*any two from:* *unethical / not good / not right, because:* 1 pigs, suffer / have (stomach) ulcers / experience pain ; 2 pigs cannot, behave normally / move much / exercise / keep fit / socialise / mate ; *ethical / good / right, because:* 1 more / better quality, meat / food, for humans ; 2 pigs suffer less than (normal) pigs given hGH by injection ;	**2**