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***PLEASE can you mark this worksheet as accurately as possible

Lesson 1

Question 1 [12]

1. (a) restriction (1)
(b) ligase (1)
2. transgenic/genetically engineered/GMO/genetically modified organism (1)
3. agriculture – crops that are – pest/weed/drought/saline soil resistant produce more/survive better/ better income for farmers
therapeutic – medicinal products e.g. insulin/growth hormone /human products not rejected by human body/greater quantities produced/cheaper to produce (4)
4. (a) organism used to transfer a gene to another organism
Bacteria reproduce quickly so many copies of the gene can be made quickly /
Bacteria can target a specific tissue so can get new gene into correct cells
Any other suitable answer 1 + 2 = (3)
- (b) micro-organisms could cause disease/cancer in tissue if micro-organisms genes reactivated /micro-org could infect incorrect crop cause engineered genes to be spread randomly into environment
Any other suitable answer (2)

Question 2 [18]

- a) A vector is a vehicle/means by which foreign genetic material (DNA) is transferred (✓) into another cell/host cell. (✓) (2)
- b) A vector is involved in steps 3 (✓) and 4 (✓) (2)
- c)
 - Plasmids are circular (✓), double stranded DNA (✓)
 - They are not part of the bacterial chromosome and replicate independently of it (✓)
 - Found in prokaryotic cells (✓) (4)
2. Restriction enzymes (✓) cut both strands of a DNA molecule at a certain point to isolate a specific gene (✓), human insulin gene in this case. (✓) (3)
3. The human insulin gene is joined with the bacterial DNA/plasmid (✓) by ligase enzymes (✓) which then reconnect the plasmid ring/joins the two strands of DNA together to form recombinant DNA (✓). (3)

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4. Economical – bacterial reproduce very quickly (✓) and can produce large quantities of insulin cost effectively (✓);

Health benefits – human insulin does not cause the same ill effects as using animal insulin (✓) because animal and human insulin is slightly different (✓). (4)

Question 3 [3]

1. Triploid orange no seeds/usually sterile/larger fruit /triploid $> 2n$ (any 2) (2)
2. Improved size of fruit / better nutritional value /create seedless varieties (1)

Question 4 [6]

1. Remained low and constant between 1900 and 1980. Increased in last 20 years. (2)
2. 1980 – 2000 (1)
3. $6.6 \text{ t/ha} - 2.2 \text{ t/ha} = 4.4 \text{ tons/ha}$ (1)
- 4.a) Selective breeding. To crossbreed with desirable traits and improve quality.

OR

GMOs – Using vectors to insert genes into wheat to improve nutrition/pest resistance/drought resistance. (2)

Question 5 [12]

1. GMO an organism that has had a selected/desired foreign gene/alterd genetic makeup inserted into its genome/chromosomes (*or other correct definition*)
- 2 (a) Access to research facilities /funds to develop GMOs/large nation requiring large amounts/successful crop yield *any suitable answer* (1)
- (b) $100\% - (21\% + 6\% + 4\% + 4\% + 1\% + 1\%) = 63\%$ (2)
 $(99\% - (21\% + 6\% + 4\% + 4\% + 1\% + 1\%)) = 62\%$
- 3 (a) advantages: pest/drought/herbicide resistance; increased nutritional value; increased yield; feed increased population numbers; lower production costs, etc.
Any two (or other reasonable advantage). (2)
 Disadvantages: may introduce allergenic properties; disrupt food chains; may introduce mutagens to food; etc.
Any two (or other reasonable disadvantage). (2)
- (b) yes/no (*relate answer specifically to SA*)
 e.g. Yes: rapidly growing pop numbers will provide sufficient food
 e.g. No: need to test more thoroughly to see if produces diseases, etc. *other suitable answers explained, e.g. allergenic; destroying food chains, etc.* (3)

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Question 6 [8]

1. when it is genetically identical to another/a line of genetically identical individuals (2)
2. 46 (1)
3. 2 only (2)
4. fallopian tube (1)
5. (a) interfering with natural processes/playing God (1)
(b) new human life is being experimented upon (1)

Question 7 [14]

1. May 7 2003 (full date) (1)
2. Futhi means replica/repeat A replica is an exact copy The calf is a genetically identical/a clone of/has the same DNA as the parent (3)
3. (a) sexual reproduction (or explanation thereof) (1)
(b) Any 2 of ... crossing over , random fusion of gametes; independent assortment/random alignment during meiosis (2)
4. Protective covering of the egg left on in normal cloning (1)
5. uterus (1)
6. Many (clones) can be made 9 of highly productive livestock (1)
7. Producing the clone, i.e. viable embryo itself
OR When the egg is inserted into the recipient (1)
8. Isolation phase: Any 1 of ... Remove gene for high yield from high yielding donor
Engineer phase: Any 1 of ... Genetically engineer a bacterium/plasmid to contain this gene
Insertion phase: Any 1 of ... Infect the cow with the bacterium OR any other reasonable 3 step process (3)

[Total: 73 Marks]