1.11 Biology: Genetics, Populations and Evolution: 10-minute Pack

AQA 7402 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A gardener grows a variety of runner bean with a diploid chromosome number of 2n = 22 (n = 11 pairs of homologous chromosomes). Like all organisms that reproduce sexually, the genetic variation seen among the offspring of two runner bean plants arises largely from events that occur during meiosis.

(a) Explain how crossing over during meiosis I can produce gametes with new combinations of alleles that were not present in either parent plant. **(2)**

(b) Explain how independent assortment of homologous chromosomes during meiosis I increases the genetic variation of the gametes produced. **(2)**

(c) Ignoring any effect of crossing over, calculate the number of genetically different gamete combinations that independent assortment alone could produce in this runner bean plant. **(2)**

(Total for Question 1 is 6 marks)

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Mark scheme · 1.11 Biology: Genetics, Populations and Evolution: 10-minute Pack

Question 1

(a) non-sister chromatids of a homologous pair become physically joined at a chiasma (during prophase I) and exchange section(s) of DNA/alleles **B1**

(a) this produces recombinant chromatids carrying new combinations of alleles that differ from either parental chromosome **B1**

(a) Answer: Crossing over exchanges sections of DNA between non-sister chromatids of homologous chromosomes at chiasmata, producing recombinant chromosomes with new allele combinations.

(b) each homologous pair orientates/lines up randomly and independently of every other pair at the equator during metaphase I **B1**

(b) so maternal and paternal chromosomes are distributed to daughter cells in many different possible combinations **B1**

(b) Answer: Random, independent orientation of each homologous pair at metaphase I means maternal and paternal chromosomes end up distributed in many different combinations in the resulting gametes.

(c) uses 2^n with n = 11 (the haploid number) **M1**

(c) 2048 cao **A1**

(c) Answer: 2048

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